Disposal of Street Refuse in Glasgow.*

The problem of how best to dispose of street refuse seems to be in a fair way of solution in Glasgow (Scotland,) where inclosed spaces fitted up with suitable machinery and appliances for dealing with and dispatching daily, as collected, the heterogeneous street refuse are provided by the Cleansing Committee of the City Council.

The objects the committee has in view are—(1) To have each day's collection of refuse dispatched to the country directly as it is brought in by the scavenging carts, and thus do away with the storing depots in the city, which the authorities and the citizens generally have been so anxious to see abolished; and (2) to have the refuse dealt with and loaded mechanically, so that only the manurial portion, freed of all rubbish, will be sent to the farmers; while of the non-manurial portion, everything which can be sold or utilized with advantage will be turned to the best account, and the remainder reduced to inoffensive clinkers by cremation. The first work of the kind in Glasgow was started three years ago. Another has been nearly completed with such improvements as experience has suggested. The principle adopted is to have refuse of all sorts carted on to the highest point, so that without the use of elevators the whole material is mechanically dealt with as it descends—the manurial portion being delivered into the railway wagons, the cinders in front of the boilers, other articles for use or sale, such as old iron, meat tins, old boots, etc., to places appointed for respectively, and all other unsaleable rubbish into cremating furnaces. The area of ground occupied (including street) is 5,100 sq. yds. The machinery house proper is a substantial three-story building, 117 ft. by 91 ft., the top floor of which measures 117 ft. by 134 ft. The entrance gate is 16 ft. above the level of the ground floor, and practically level with the middle floor of the machinery house. The top floor is 16 ft. above the entrance level, and is reached by an inclined roadway rising 1 in 20. There is a neat octagonal gate-house at the entrance. All the carts on entering pass on to the weigh-bridge, and are weighed by the gateman. Any material such as stable manure, which requires no manipulation, is carted straight into the middle floor, where closed hatches are provided for simply shooting it into the railway wagons.

All the city refuse, which is composed of (1) contents of ashpits and bins, (2) excreta, and (3) street sweepings, is taken to the top floor, where special provision is made for each variety. The contents of ashpits and bins—these forming, of course, much the largest quantity, are shot into revolving screens of new design, erected close under the girders. Each screen (making fourteen revolutions per minute) has a double action, and, although in one piece, is practically a screen within a screen. By the first action upon the inner mesh, sloping from west to east, all the rougher rubbish, which will not pass through a 1½ in. opening, is separated and delivered to a traveling carrier at the east end of the screen; and by the second action upon the outer mesh, sloping in the opposite direction, the material which has passed through the inner mesh travels back over the ½ in. outer mesh. The material—chiefly cinder—which passes over this ½ in. mesh is delivered at the opposite end of the screen from the rubbish, and is thereafter passed down a shoot to the front of the boilers, where it is used as fuel and serves to raise steam for the works. The fine ash and small manurial particles fall through both meshes of the screen, and thence down a shoot into mixing machines, which stand upon an elevated platform on the floor immediately below. In these mixers there passes at the same time a mechanically regulated quantity of excreta. The carts and vans in which this material is collected also ascend to the top floor, where the contents are passed through gratings into closed cast-iron tanks, which rest on the second floor, and from which, by a simple mechanical arrangement, the desired supply is allowed to escape to the mixers along with the fine ash, which absorbs and deodorizes it.

In order to fix the ammonia and deodorize the compound, provision is made for adding sulphuric acid or other disinfectant or deodorant to the excreta in the tanks. The other material which is shot into the mixer is the consolidated detritus from the paved streets of the city. These sloppy sweepings are also carted to the top floor, where provision is made for having them shot through a series of openings near the gables into large cast-iron tanks. These draining tanks are of novel construction and specially designed for this purpose. They have sloping bottoms, and are provided with apparatus for draining off the water as it is pressed to the surface. When the contents are sufficiently drained, the large doors in the front are gradually raised by means of chain barrels and worm gear, and the residuum, which is pulpy and rich looking, is shot down as desired into the mixers. Thus the various manurial constituents of the refuse are passed in regulated quantities into the mixing machines, whose revolving blades thoroughly mix the whole into a deodorized compound, which is delivered into the railway wagons direct, and the farmers are supplied with a prepared manure in good condition for spreading on the land.

The rough rubbish, it has been observed, is delivered by the inner screen on to a traveling carrier. This is an endless web of iron plates on pitched chains, which is made to travel 30 ft. per minute. Women are stationed in front of it to pick off anything which can be sold or utilized. One picks off first of all what is manurial, such as dirty straw, pulsy matter, vegetable refuse, etc., and this garbage she drops down a shoot by her side into the wagon direct, where it gets mixed with the compound as it comes from the mixer. The other materials picked off for use are old iron, old boots, meat tins, rags, paper, etc. The remainder is shot from the carrier into a specially constructed cremating furnace, where it is reduced to clinkers, which are, of course, innocuous, and, like common furnace ashes, go to make roads or fill up ground. The various articles of salvage above referred to are mostly sold to persons who can make use of them. Old iron goes for precipitating copper; ammonia is extracted from old boots; solder is taken from meat tins; and so on.

There are four sets of rails running inside the building, with a traverser at the north end for shifting wagons from the one set to the other; and provision is made for doing all the traversing and haulage by steam-power. In the erection of the works special attention has been given to the question of ventilation. A very large fan, driven by a 30 horse-power engine, and capable of passing 29,000 cubic ft. of air per minute, is made to exhaust constantly from the soil and mixing chambers, and to blow the vitiated air through large pipes leading into the ashpits of the cremating furnaces, thus supplying the fires with air under a slight pressure. This is obviously a thorough way of dealing with it and of preventing nuisance outside of the building. For light and further ventilation a large opening or well, 31 ft. by 21 ft., is left near the centre of the building, immediately over the cremating furnaces. A large bell mouth, 10 ft. diameter, is hung from the roof over this well, and connected by a 3 ft. sheet-iron flue to an annular space in the chimney stack. This draws off the vapors which are formed in the process of cooling the red-hot clinkers withdrawn from the furnaces and boilers, thus keeping the building free and clear from sweating. The chimney is 250 ft. in height, 20 ft. diameter at the base, and 10 ft. diameter at the top. Steam at 60 lb. pressure is raised by means of the cinder fuel in two Lancashire boilers of 50 horse-power each. The machinery—all in duplicate—is driven by a high pressure coupled horizontal engine capable of developing 80 horse-power. The cleanliness and comfort, outward and inward, of the work people of both sexes have not been forgotten, suitable lavatories and baths having been provided for them, and also mess rooms with the necessary cooking and heating conveniences.

Provision has been made for the district carting establishment of the department on the same piece of ground. The portion next Crawford street has been utilized as stabling accommodation for thirty-four horses and their harness, with the necessary cooking and forage arrangements. Under the stables, which are raised on girder work and approached by an inclined gangway, there are large storage sheds for carts and other vehicles and plant, and in the small open yard in front of these sheds provision is made for hose washing the carts as they were brought in. Over the stables there are commodious hay and straw lofts, and close to the gate-house there are dwelling houses for the works manager and carting foreman respectively. A great deal has had to be accomplished on a comparatively small space, and it has been done to the very best advantage. The works have been planned and their erection supervised, under the Cleansing Committee, by Mr. Young, Inspector of Cleansing, and his assistants.

*From Glasgow *Sanitary Journal*.

Use of Iron Sleepers on Tramways.

A recent issue of *Le Génie Civil* contains some observations concerning the use of iron sleepers on the Paris tramways. The tramways were first introduced into France by Mr. Loubat in the year 1852, but made little progress until 1873, when concessions were obtained for the construction of 64 miles (103,500 m.) of lines in Paris. This concession was divided into three systems, which were allotted respectively to the Compagnie Générale des Omnibus, the Compagnie des Tramways-Nord, and the Compagnie des Tramways-Sud. The ordinary grooved tramway rail, spiked to a longitudinal timber sleeper, was first adopted. The weight of rails used at first was 38 pounds per yard, which rails were found to last ten years; but a 46-pound rail was subsequently introduced, which was estimated to have a life of 20 years. The Compagnie des Omnibus have since and up to the present time used a grooved rail of about the same weight (40 to 48 pounds per yard,) fastened to a longitudinal sleeper by a countersunk bolt passing through the bottom of the groove. In this system it is found that the holes bored vertically through the sleeper permit the infiltration of water and hasten the decay of the timber and loosening of the bolts. The company are now making trial of a system introduced by Mr. Marsillon, which has been in use some time on the Lille tramways, consisting of an ordinary bridge rail and counter rail of light section bolted to an iron longitudinal sleeper. This system, from the absence of timber, forms a more durable road, but is much less elastic under the passage of the wheels than the older modes of construction. It is found that the counter rail should have the same section as the rail, in order that it may stand the wear and tear of the ordinary road traffic.

IT is probable that State Engineer Nettleton of Colorado, will make an exhibit at the Denver Exposition showing the practical workings of irrigation and the proper and scientific method of measuring water.

The Garabit Viaduct.

In our issue of August 9, we gave several general views of the Garabit Viaduct and a short description; at the risk of some repetition we now show this remarkable structure more in detail and describe more fully the great arch and its principal features.

The arch span on springing line is 541.2 ft., about 16$\frac{4}{10}$ ft. more than its predecessor, the Douro Arch; the rise is 170.09 ft. while that of the Douro was only 122 ft., and the depth of the arch at the crown is 32$\frac{5}{10}$ ft.

The arch itself is made up of two principal members connected by latticed trusses. On plan it is 65$\frac{6}{10}$ ft. wide at the spring and narrows to 20$\frac{5}{10}$ ft. at the crown on the extrados. The governing or medial line of the arch is a parabola of the 2nd degree, giving to the haunches a very light curvature.

The arch presents a key of great depth and terminates at the springing line in the hinged joint and its bolster shown in the plan. The arch trusses are made up of intrados and extrados members (see plan) or upper and lower chords, boxed in form and made up of plates and angles as shown. These chords are tied together by a single cancellation truss, with the posts vertical and the panels solid near the spring of the arch. Both the posts and the diagonals are made of plates and angles, latticed. The lateral and stay bracing is similar in form to the other members. The roadway truss is cut at the points over the piers resting upon the arch, and this central portion of the upper truss actually forms a part of the arch. The other two parts of the upper truss are fixed upon the arch abutment piers with their *inner ends* resting upon rollers carried by the arch piers. At the Douro Bridge the horizontal truss extended over the arch piers, with a joint in the neighborhood of the crown of the arch only. The plan adopted at the Garabit Viaduct was intended to prevent that increase of stress which would produce in continuous girders a vertical displacement of the piers by the effect due unsymmetrical loading. By this arrangement this displacement does not act upon the intermediate truss but only upon the extremities where it has little value. The arch is tied to the masonry of the abutment piers by strong iron anchors although the calculations have demonstrated that this precaution was useless. This anchorage, however, was relatively inexpensive and provides a surplus of security too important to be abandoned.

The iron piers, above the masonry, have the following heights:—199.2, 167.9, 119.6, and 80.4 ft., the foundation piers are built of cut granite and are hollow. The masonry under the main piers has an arch through it parallel to the axis of the viaduct and 39.4 ft. span. The interior masonry, in the prolongation of the mean curve of the arch, is coursed normally to this curve to better distribute the pressure. The iron piers are built upon a plan patented by M. Eiffel; they are pyramidal in form, with a batter to the vertical of about 1 inch in 9 in. for the main piers and 1 inch in 12 in. for the others, in the plane of the viaduct, and 1 in. in 26 in. transversely. The height of the bracing stages is generally 32.8 ft. They finish at the top in a capping arranged to support the horizontal trusses, and the top dimensions are 7.65 ft. longitudinally and 16.4 ft. transversely. The posts of the piers are made of angles and plates open on the interior face and latticed, U-form in section. The bracing is latticed. These piers are all anchored to the masonry by strong bolts passing to anchor plates situated in galleries in the base of the piers.

In our previous article we have given the data of load, etc., to be used in calculating the arch, and will not repeat them here; only adding the results expected by M. Boyer in figuring upon the deformation of the arch under its permanent and moving load, effect of temperature, etc.

Under the permanent load he calculates that the arch will sink at the crown, 0.65 in., and under the combined load 1.37 in. Under a change of temperature of 30° C., the arch should sink 2.05 in. so that under the simultaneous action of moving load and temperature the total depression should be 3.42 in. It should be remarked however, that the adjacent metallic piers will be subjected to similar depressions; and under these conditions the slopes produced would be very slight. The displacement of the top of the unloaded arch, from wind pressure, would be about 0.93 in.

The Erection of the Viaduct. The first work done was the construction of the service bridge shown on general plan; this bridge was 25 ft. wide, 108$\frac{1}{2}$ ft. high, above the water surface of the Truyére; it cost $4,000. One end of this bridge was connected with the main post-route by a road leading down the ravine.

The masonry was then built and the iron piers erected upon them. While this was going on, the workmen put together upon the embankments, at the extremities of the viaduct, the two horizontal trusses which, starting from the arch-piers, would extend as far as the ends of the viaduct in masonry. These trusses, as soon as completed, were launched and pulled into the position shown on working plan. The Marvejols truss was stopped at the first masonry pier, the inner end extending six panels beyond Pier No. 4, or the first main pier. The Neussargues truss extended in like manner six panels inside of Pier No. 5, with the outer end resting upon the masonry pier and the abutment. The extreme ends of these two truss systems were firmly anchored to the abutment masonry at the extremities of the viaduct by twenty-eight steel cables to each.

Preparation was now made for the erection of the arch. False works were first built up to the level of the springing line at the extremities of the arch and upon these the intrados members of panels 1 and 2 were put in place, above these were erected the posts, braces, etc., completing these panels. The arch was then stayed by means of braces running to the iron pier and extending upward to the first stage of pier-bracing and this portion of the work suspended by steel cables from the top of the main pier.

The arrangement for mounting the remaining portions of the arch was as follows:

1st. Upon the upper member of the two trusses was a horizontal framework carrying a rolling crane, somewhat like that used in hoisting cut-stone, with the top slightly inclined towards the ravine and two small railed platforms to protect the men manipulating the hoisting crabs. The truss members were carried upon a railway on the service bridge under the position they were to occupy in the arch, and, at first, hoisted by chains passing to pullies in the upper truss. Nets were spread under the workmen to prevent accident.

2nd. Immediately over the two main piers were erected two timber pyramids, the tops of which sustained a carrying-cable of steel crossing the space separating the two piers. This cable supported two trucks, which were used in the erection of the lighter members, the cranes upon the arch being reserved for the handling of the heavier portions.

By these two means combined, the arch was gradually erected, the portions connected being sustained successively by systems of steel cables extending from the top of the main piers, as explained in the previous article.

The anchorage system consisted of the arch cables (increasing in number from twenty to twenty-four) extending to the summits of Piers 4 and 5; the horizontal trusses and the twenty-eight cables binding the ends of these trusses to the masonry at the extremities of the viaduct.

These cables were made of steel, had a heart of hemp and had eight strands of nineteen wires each; each wire 0.085 in. in diameter.

The attachment of the cables to the truss was a matter of extreme difficulty, and the system adopted was that invented by M. Eiffel at the Douro viaduct; it was as follows: The end of each cable entered a wrought-iron socket with a conical opening, the wires of the cable were spread out against the sides of this conical hole and held in this position by a second hollow cone, which was introduced into the axis of the first, and into the interior of this second cone the ends of the wires were turned back. A fusible alloy was then poured between the two cones and into the interior of the inner one, making an extremely powerful head for the cable and one that was easily attached to the iron cross-pieces arranged to receive them. Each system of cables was attached to one cross-piece in the top of the main pier, and by means of wedges and a hydraulic pump with a manometer attached, the exact strain upon each cable was easily determined. The two ends of any one cable were always opposite each other upon the upper truss, the cable passing around the arch member, or under the anchorage shoes in the abutments, over a half-cylinder of cast-iron, or saddle, 23$\frac{5}{10}$ inches in diameter. This prevented any abnormal strain upon the cable.

The keying-in of the arch presented no difficulty whatever, the space was well calculated and the closing pieces fitted exactly. The key was put in place on April 26th of this year.

The cost of the work was estimated as follows:

Masonry at the ends of the viaduct	390,032 Fr.
" under the secondary piers	84,992 "
" " " main piers	204,700 "
Total	679,724 Fr.
Contingencies	70,275 "
Masonry Total ($150,000)	750,000 Fr.
Iron and plates for the upper trusses and the piers, at 0fr. 61	1,189,500 "
Iron for the Arch, at 0fr. 91	1,046,500 "
Cast-iron, at 0fr. 45	4,500 "
" " faced, etc., at 0fr. 55	19,437 "
Cast Steel	5,000 "
Lead	1,200 "
Total	2,266,137 Fr
Contingencies	83,863 "
Total for metallic portion ($470,000)	2,350,000 Fr

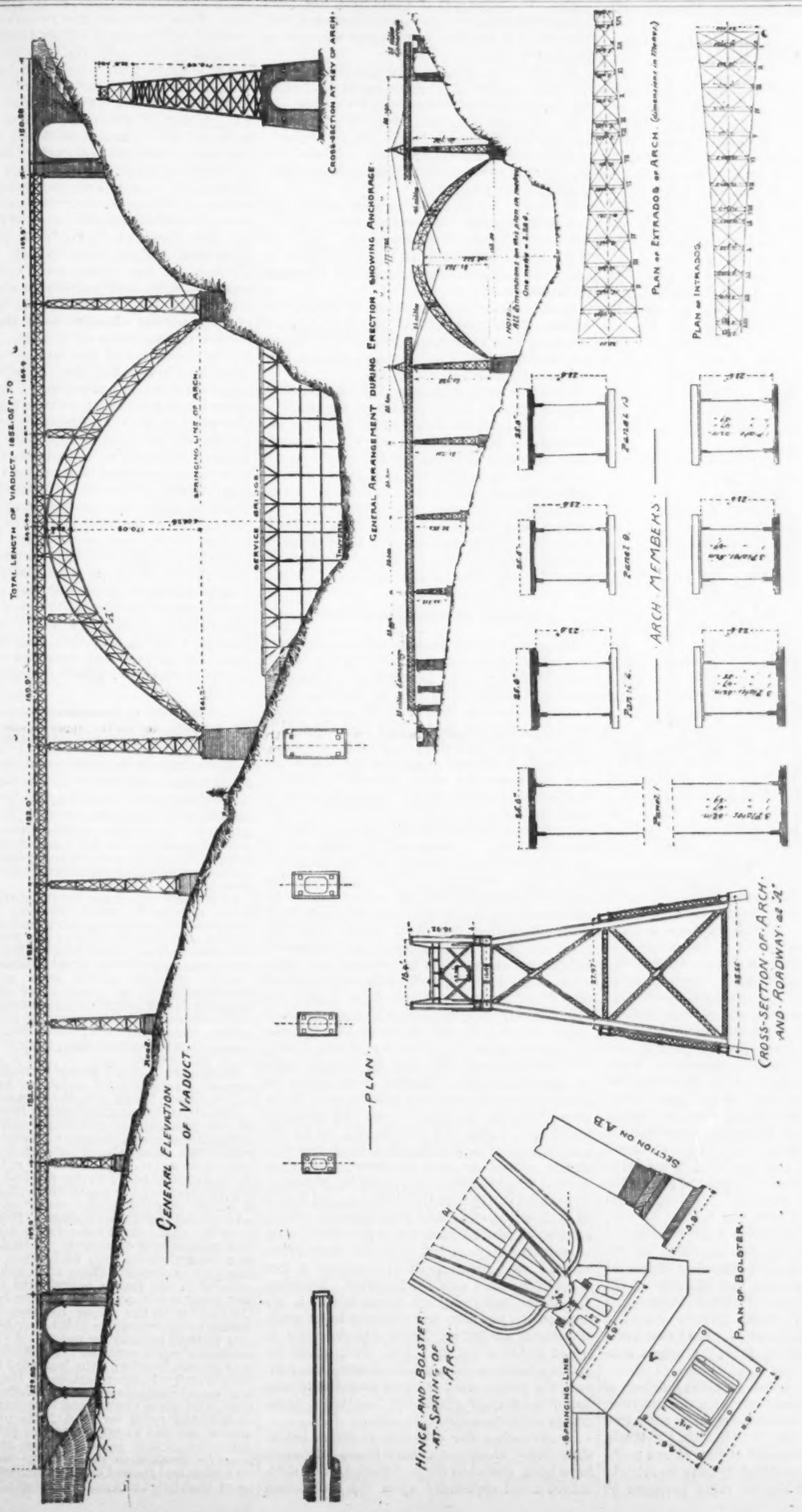
The general total of above, or estimated cost was thus 3,100,000 fr., or $620,000.

Sanitary Precautions in Pekin, China.

A Pekin correspondent of the *Pall Mall Gazette* speaks as follows of sanitary measures in Pekin:

We are just through our annual process of sanitation. No foreigner who did not know what this meant would ever guess what it is. Chinamen in many things go to work the very opposite way to foreigners. The health of Pekin is secured by opening the sewers all along the great streets, dipping out the accumulations of filth, and spreading it out in great black, slimy ponds among the business places and crowded thoroughfares. These holes seem everywhere, and woe betide the man who attempts to go about at night without a lantern. The Chinese say that this opening of the drains is necessary; without it there would be fever and plague. Foreigners laugh to scorn the precaution, but the Chinaman is right after all. The drains have no fall to speak of; they cannot be said to run. Filth gets stored up here and there. If left untouched it would get worse and worse; brought up and spread out in the sun it soon dries, the poison is dissipated and the consolidated mud is incorporated into the mass of the roadway. Of course it is only the excessive dryness of the climate of Pekin which makes such a process possible. When just dipped out the smell is bad, when rain falls the smell revives; but the sun soon once more dries all up and makes things pleasant again."

ENGINEERING NEWS—Three months for One Dollar.


General Elevation of Viaduct.
Plan.
General Arrangement during Erection, showing Anchorage.
Plan of Extrados of Arch
Plan of Intrados.
Arch Members.
Cross-section of Arch and Roadway at A.
Hinge and Bolster at Spring of Arch.
Plan of Bolster.
Section on AB

THE GARABIT VIADUCT.

On the Use of Lead Pipes for Water Supply.

BY A. HAMEN, MEMBER OF THE FRENCH SOCIETY OF HYGIENE, ETC.

In France since 1862 the use of lead-pipes for beer, wine, cider, and other liquids has been forbidden by order of the police. In 1879 it was forbidden to use lead in the paper called tin foil, which is made use of in wrapping cheese, chocolate, tea, and in the glazing of earthenware (1874). It was also forbidden to make use of old wood from torn-down buildings in heating baking-ovens (1875). It was also forbidden to use lead in closing the holes in millstones used for grinding flour.

According to the statements of our best physicians, Chevallier, Tardieu, Gautier, and others, lead, even in the smallest possible quantity, is a source of great danger when it is daily absorbed, as is the case where water is distributed by means of lead-pipes. It is thus that the celebrated Rasori has written: "*The most remarkable accidents caused by lead are those where this substance is taken into the system in small quantities at a time, but repeatedly.*"

The layer which forms in the pipes generally consists of carbonate of lead. This deposit, almost insoluble in pure water, is readily dissolved in water containing ammonia salts, nitrites, nitrates, and organic matter; but all potable waters contain more or less of these bodies. It is the same thing with the phosphate and sulphate of lime, which dissolve in water containing organic matter. Moreover, this coating is detached in pieces by many shocks suffered by the pipes, shocks, known under the name of "*coups de bèlier.*" The lead-salts are thus more or less suspended in water and we absorb them with the water. We cannot remove the lead suspended except by filtering the water over wood or bone charcoal. This filtering would not remove the lead in solution, for in order that the latter might be removed a chemical reaction is necessary, in order that the lead may be precipitated, either in the metallic state or as an insoluble salt. It is therefore certain that water contaminated by lead in solution may be filtered over charcoal without, by this means, being freed from the lead it contains.

When the lead-pipes are, as Professor Nichols remarks, alternately exposed to the contact of air or water, the corrosion of the lead is more rapid. Yet this happens daily in the distribution of water, even where this is of so-called *constant flow*. Moreover, in provision for drainage and water supply, use is made of large pipes of cast-iron, of lead tubes for upright lines and branches, and of copper-taps; by the permanent contact of these metals a galvanic current is formed which greatly aids the attacking of the lead by the water. From this actual state of affairs, it is plain that the action which may be made to take place in experiments in the laboratory does, in reality, daily take place, only it is even more intense. If the injurious effects produced by such a state of affairs are not apparent, it is simply because we expect that *colic* should always be the result of lead *toxication*. We forget that the lead introduced into the system in very small quantity changes the inmost nature of our tissues, and injures the nutrition of our organs in consequence of chemical reactions which take place during the passing of the lead molecule through our organs. Then result cerebro-spinal and genito-urinary troubles, anæmia, dyspepsia, pseudo typhoid fever, and other diseases of which, often, the origin cannot be traced

From a sanitary point of view, judging of the habitual use of lead-pipes for the distribution of water, we cannot conclude that this method is without danger to health. In truth, experience from this point of view shows nothing less than that we certainly have no more to seek in this direction; no more progress to make. For hundreds of years man has lived without sewers, yet this has not rendered their introduction any the less a great advance in sanitary science.

In 1882, in Prague, Austria, on a report made by Professor Dr. Topper, the use of lead-pipes for distribution of water was forbidden. In 1876, the International Congress of Hygiene also forbade the use of lead-pipes for water.

As to Paris, Professor Nichols is mistaken in stating that the opinion of Bobiere is that lead-pipes are not injurious,

In 1873-74 during the discussion of this subject at the academy of Sciences, the chemists, Fordos, Bobiere, Mayencon, and Bergeret Marias, asserted that the potable waters do affect lead, contrary to the opinions advanced by Belgrand.

At this time 907 physicians of Paris, and among them members of the Academy of Sciences, the Academy of Medicine, professors, and hospital physicians, requested that the use of lead-pipes be forbidden.

Later, in 1881, Professor Armand Gautier, member of the Academy of Medicine, made a new analysis on the waters of Paris, and found measurable quantities of lead, which, though small, led him to declare that it would be desirable to no longer use lead-pipes, and as Arthur Hazlewood, member of the State Board of Health of Michigan, said in 1876: "The use of lead unprotected from the action of liquid in contact therewith cannot be too severely condemned in all cases where the water or other liquid is to be used for food or drink."

Railway Construction in India

The report of the English Select Committee on Indian Railways has been issued to the public this week, and it is likely to have an important bearing upon the developement of wheat production in India. The committee state that they have devoted their attention mainly to the alleged necessity for more rapid extension of railway communication in India and the means by which this object may be best accomplished. In the first instance they refer to the chief recommendations of the committee which in 1878 and 1879 inquired into the expediency of constructing public works for the prevention of famine and the developement of the resources of the country. That committee advised that the outlay should be limited to £2,500,000 per annum, and their recommendation has been acted upon, the government of India having since annually applied about £1,800,000 to railways and £700,000 to irrigation. The policy has been to leave to private enterprise those lines which are commercially most attractive, and to construct, either directly by the state or through the agency of companies (under a guarantee), such lines as have been regarded as indispensable for protection against famine or for other urgent purposes, though not promising to be remunerative for the time being. As to future operations, a plan has been drawn up by the government of India showing what railways should sooner or later be made. These are divided into two schedules, A and B. Schedule B contains thirty-four lines, with a total length of 3,432½ miles, of which the estimated cost is £24,288,000; and as these are expected to be remunerative they are left to private enterprise, without any government aid beyond a free grant of the land required for them. Schedule A contains thirty projects, many of which are in progress, but 3,896 miles remain to be made at a cost of £28,262,450, which it is proposed to spend within about six years. Part of the necessary funds to the amount of £200,000 per annum the government of India proposes to take out of the famine grant; but the Select Committee condemns that proposal.

In reviewing the evidence brought before them—the most important items of which have been stated in these columns—the committee dwell especially upon the statements made by witness in relation to wheat production. They point out the remarkable developement of the Indian export trade in wheat. The quantity of wheat exported from India in the five years from 1876—77 to 1880—81 was only, on an average, 4,544,000 cwt., valued at £1,951,000; whereas in 1881—82 it was 19,901,100 cwt., valued at £8,870,000; in 1882—83 it was 14,144,000 cwt., valued at £6,069,000, and in 1883—84 it was 20,961,000 cwt., valued at £8,880,000. It is remarked that the cultivators have been induced not only to substitute wheat for less remunerating crops, but also to extend the area of cultivation and to improve their farming; also, that, as railways tap fresh districts, more sources of supply are found. In certain districts, too, new railways will open up valuable coal fields and possibly iron mines in a few cases. After noticing the information given by several witnesses as to the improvement of the condition of the people through the developement of the railway system, the committee state that they consider the evidences in favor of a more rapid extension of railway communication to be conclusive, and they go on to say that they are of opinion that the amount proposed to be spent on railways by the government of India during the next six years is moderate and likely to have very beneficial effects. If the necessary loan can be really raised in India they consider it advantageous so to obtain it; but they appear to doubt the possibility. In conclusion, while expressing an opinion to the effect that the present limit of borrowing £2,500,000 might with safety be enlarged, they think the full responsibility of deciding upon the amount to be borrowed from year to year should rest with the secretary of State in Council, and they emphatically declare that the proposed extension of railways should not involve additional taxation.—*Bradstreets.*

Processes for Copying Drawings and Tracings.

Of the various processes commonly used by draughstmen and others for producing duplicates of drawings, tracings, etc., the following are probably the most common: Blue process, negative, producing white lines on blue ground; positive, having blue lines on white ground; black lines on white ground, Daudy process; white lines on brownish ground, silver process.

Of all these processes the ordinary blue negative system is most used, as being the cheapest, the easiest to work, and as yielding results which fulfill all necessary requirements. To make ordinary blue prints there is necessary some good blue print solution, a good quality of white paper, such as Weston's drawing paper, a sponge free from grit, a printing frame, such as photographers use, and a dish or tank depending on the size of the prints, as does also the frame. But, for convenience, we will suppose the prints will be under 14″ × 17′ in size.

There are a good many formulas floating around for blue print solution, but the one which I have found to be the best is as follows:

One ounce ammonia citrate of iron, one ounce of red prussiate of potash; dissolve the red prussiate in seven ounces of water and, separately the ammonia citrate of iron in five ounces of water; mix these two solutions and the solution is ready to be applied. To apply the solution lay the paper down flat and pour a small quantity in the center of the sheet, and spread it with the sponge uniformly, going over the whole sheet twice to be sure no spot has been missed or unevenly coated. Hang up in a dark place to dry, and when dry spread the tracing over the blue paper, ink side from, and put in the frame, being sure the tracing and sheet are in contact. Expose to sun or in the light until the paper becomes a greenish mouse color, when the print may be taken out and washed in running water. As the time of exposure varies with the intensity of the light, no rule can be given; the beginner had better keep a strip of paper outside of the frame and tear small samples off and wash from time to time, and when the desired blue color is reached take the print out. A little practice will enable any one to tell when the print is done. After the print is removed from the frame it must be washed in clean water on both face and back, and should, when sufficiently washed, be of that bright blue characteristic of Prus-

sian blue, and the lines should be clean, white lines.

This process, from its yielding a negative picture, is known as the Ferro Negative Process to distinguish it from similar processes giving blue lines on a white ground known as the Ferro Positive Process.

The latter is much more difficult of manipulation and requires more apparatus, so while the beauty of the process strongly commends it, these difficulties, and the fact that the cheaper and easier worked negative processes furnishes copies that answer every purpose in the shop and in the drawing room, have limited its use. The paper is now prepared and offered for sale by the roll, directions accompanying each roll. The final outlay makes experimenting rather more expensive than one would believe on seeing the advertisements, which are usually not very explicit in directions.

This ferro-positive is scientifically known as Pellet's process, being discovered by H. Pellet, of Paris, and his formula is as follows:

Per-chloride of iron, .	10 parts.
Water, ...	100 "
Citric acid, ...	5 "

The paper used should be the best and should be sensitized either floating on a bath of the above or applied with a sponge as before described for negative blue paper. Of course this should be made in a dark room. To manipulate the prints there is necessary, in addition to the water dish or tank, two other tanks, one to contain the developing solution, consisting of

Yellow prussiate of potash,	24 parts.
Water, . . .	100 "

And another for intensifying solutions of

Hydrochloric acid, .	1 part.
Water	10 "

The time for exposing this paper varies from forty seconds to one half hour, depending on the light. When properly exposed the image should be a light canary on an orange ground.

The print, after remaining in the solution of yellow prussiate of potash, should have light blue lines on a white ground. On immersing in the acid solution the blue lines become more intense.

Print may now be taken out and washed, and should have a clean white ground with sharp blue lines.

The care necessary to get good results with this process puts its practice beyond the average manipulator.

There are several other processes slightly used, such as silver and curomium, for copying drawings, etc., but they possess no striking advantage over those already mentioned. There is one, however, which might be mentioned as coming into favor, the Davy process, black lines on a white ground.

The prints are made as in blue process printing, with one development. For this process, however, I am unable to furnish formula.

Yours,

R. M.

Journal of Ry. Appliances.

The Hell Gate Improvement and Connection of the Hudson and Harlem Rivers.

Gen. Newton has made his annual report on the removal of obstructions in East River and Hell Gate, New York. He says:

Owing to the failure of the River and Harbor bill to pass in 1883, it became necessary to reserve a sufficient balance to provide for the extensive and valuable plant belonging to this appropriation, and the funds so reserved have been devoted during the year to that purpose. The appropriation for improving East River and Hell Gate for the year ending June 30, 1875, is limited to "removing the reef at Hell Gate."

A hitherto unknown rock off Twentieth Street, East River, has recently been struck by one of the Boston steamers, and has been found to be of small size, but dangerously near the deep water channel. A reef with 21 ft. at low water also exists about 150 yds. northeast of the place occupied by Dimond Reef previous to its removal. These two rocks, together with Pot Rock and the remains of the Frying Pan Rock, constitute serious obstructions to deep water navigation.

The amount expended during the year ending June 30, 1884, was $25,098, and was for running the pumps to keep Flood Rock clear of water, and for watching and preservation of the property.

During the year ending June 30, 1885, the available balance, $371,979, will be applied to extending the galleries in about three-quarters of an acre, drilling about 5,000 ft. of 3 in. holes in the roof, and all the holes in the pillars for the final blast, which it is expected will take place about September, 1885.

The amount that could be profitably expended in the year ending June 30, 1886, is $500,000, as follows: For completing the excavation at Flood Rock, $60,000; for removing Pot Rock and Frying Pan in Hell Gate, and a reef near Dimond Reef in East River, $180,000; for grappling and removing in part the broken stone after explosion of Flood Rock, $260,000.

The total cost of removing the débris from the explosion would probably amount to $600,000.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $1,602,964.

The amount of commerce and navigation benefited by the completion of this work is about $4,000,000 daily.

Capt. James Mercur, in charge of certain river and harbor improvements in New York, has submitted his annual report to the Chief of Engineers. The following statement shows the work contemplated, the money available, and the amount asked for the year ending June 30, 1886:

Rivers and Harbors.	*Work Contemplated.*	*Available.*	*Asked for.*
Hudson River	Construction of new dykes	$41,271	$35,102
Rondout Harbor	Completion of improvement	1,760	10,000
Buttermilk Channel	Dredging	10,658	20,000
Harlem River	Excavating a channel	400,000	.....
Gowanus Bay	Dredging	5,213	50,000
Echo Harbor	Removal of Sheepshead rock	3,366	17,000
New Rochelle Harbor	Completion of improvement	9,314	5,825
Portchester Harbor	Dredging and construction of breakwater	16,325	30,000

Accompanying Capt. Mercur's report is a letter from Gen. Newton relative to the improvement of the Harlem River, in which estimates are given for connecting the Harlem and Hudson Rivers by cuts across Manhattan Island at and near the line of Spuyten Duyvil Creek. Gen. Newton says: "I regret to find that the route by way of Dyckman's Creek presents decided financial advantages over the others, because it is to be feared that this fact may increase the reluctance of certain property holders along that line to part with the necessary land as a gift to the enterprise."

The estimates for excavating a channel 350 ft. wide and 15 ft. deep at mean low water from the Hudson River to the Harlem River, to Morris Dock, opposite Sherman's Creek, as given in Gen. Newton's letter, are: Via Dyckman's Creek, $2,091,685; via Kingsbridge, $3,038,699; via Sherman's Creek, $3,026,078.

"The estimates," Gen. Newton says, "embrace only the improvements of navigation from Morris Dock, opposite the mouth of Sherman's Creek, thence following the respective routes across or around Manhattan Island to the Hudson River, and contain no items for the removal of obstructions in the lower portion of Harlem River. From Morris Dock to its junction with the East River will cost the additional sum of $600,000. This includes the removal of the rocky reefs at the mouth of the Harlem River, upon which $21,000 has already been expended.

"It has been suggested that these reefs might be avoided by taking the line of the Bronx Kills (between Randall's Island and the mainland) as the lower route of the Harlem improvement. This line has never been examined no funds having been available for such purpose, and the cost of such change cannot be stated. Ample opportunity in the future will be presented for deciding the propriety of a change of route at this end of the line.

"I consider it proper that the Government should exercise the right of approval of all bridges, tunnels, etc., which shall be constructed across the improved Harlem, including Spuyten Duyvil (should this creek form a part of the improvement,) and I recommend until these powers be granted, that no money be disbursed by the Government for the improvement. I recommend, likewise, that one contract be entered into for opening a cut connecting the Hudson and Harlem Rivers, including the improvement of the Harlem as far down as Morris Dock."

ACCORDING to the *Detroit Post*, the park commissioners, of Detroit, Mich., are considering the construction of the new Belle Isle pier, the plans for which were recently completed. It will be about 480 ft. in length, with a dock alongside 30 ft. wide. On the pier is to be a promenade veranda covered by a series of arches. If the commissioners approve of the plans, of which there is little doubt, the work will be let by contract at an early date. A bridge is also to be built over the canal. According to the plans now in the hands of Mortimer L. Smith, the bridge is 80 ft. wide, with a 50 ft. carriage way and two 15 ft. sidewalks, with a 5 ft. passage way over the central pier from each side-walk. The material is to be wood.

The Bartholdi Statue and the Colossus of Rhodes.

It may not be without interest to compare this curiously ingenious contrivance, evolved by M. Bartholdi from a little statuette one-third smaller than life, with what is known as the Colossus of Rhodes. M. Bartholdi's figure of Liberty stands, without reckoning the diadem, 105 ft. high: but the extreme height from the feet to the upper end of the torch held by the outstretched hand is 137 ft. 9 in. The statue will be placed on a granite pedestal 83 ft. high. To those who like to be told that the letters in the inscription, "*Tues Petrus*," running round the interior of the Dome of St. Peter's at Rome are as tall as a Life Guardsman, and that the pen held by the Apostle St. Luke in one of the spandrils of the arches of the dome is 11 ft. long, it may be interesting to learn that a person 6 ft. in height, standing on the lips of M. Bartholdi's head of Liberty, can only just reach the eyebrow; that people can jump with ease in and out of the tip of the nose, and that the eyes measure 6 ft. from corner to corner. Turning to the old "Wonder of the World," we find that it was the largest of the hundred colossal statues of the Sun which at one time embellished the city of Rhodes. It was upward of 105 ft. high; few persons had arms long enough to embrace its thumb; the fingers were longer than the whole bodies of the majority of the statues then extant; the hollows of the limbs, when broken, resembled caves, and inside might be seen huge stones inserted to keep the statue in position. It took twelve years to erect, and cost three hundred talents. The story that the legs of the Colossus extended across the mouth of the harbor is generally considered to be a fiction; but that it stood close to the entrance of the port of Rhodes, and was made to serve as a pharos or light-house, seems certain enough. It was overthrown and smashed to pieces by an earthquake fifty-six years after its erection. For 903 years the fragments of this Wonder of the World strewed the mole at Rhodes, and then they were sold by the Caliph Omar to a merchant at Emesa, who carried away these prodigious marine stores on the backs of 900 camels. Hence Scaliger calculated that the aggregate weight of the bronze must have been 700,000 pounds.—*London Telegraph.*

The Age of the Earth

Richard A. Proctor says that the age of the earth is placed by some at 500,000,000 years; and still others of later time, among them the Duke of Argyll, place it at 10,000,000 years. None place it lower than 10,000,000, knowing what processes have been gone through. The earth must have become old. Newton surmised, although he could give no reason for it, that the earth would at one time lose all its water and become perfectly dry. Since then it has been found that Newton was correct. As the earth keeps cooling it will become porous, and great cavities will be formed in the interior which will take in the water. It is estimated that this process is now in progress so far that the water diminishes at the rate of the thickness of a sheet of writing paper a year. At this rate in 9,000,000 years the water will have sunk a mile, and in 15,000,000 years every trace of water will have disappeared from the face of the globe.

OBSERVATIONS taken at Colon by the engineers engaged on the Panama interoceanic canal indicated that the great earthquake wave caused by the Java eruption made its way in about thirty hours from Java round the Cape of Good Hope to the east coast of Central America.

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TABLE OF CONTENTS.

	PAGE
Disposal of Street Refuse in Glasgow	97
Use of Iron Sleepers on Tramways	97
The Garabit Viaduct (*Illustrated*)	98
Sanitary Precautions in Pekin, China	98
On the Use of Lead Pipes for Water Supply	100
Railway Construction in India	100
Processes for Copying Drawings and Tracings	100
The Hell Gate improvement and Connection of the Hudson and Harlem Rivers	101
The Bartholdi Statue and the Colossus of Rhodes	101
The Age of the Earth	101
English Locomotive Axles	102
The Severn Tunnel	102
Explosives of the "Rack-a-Rock Type"	103
Personal	103
The South Kensington Exhibition of 1885	103
Wire Rope Transmission for Pumping	103
A New System of Painting Iron	103
Berlin Sewerage	103
Turnouts (*Illustrated*)	104
Correspondence	104
History and Statistics of American Water-works	105
Water	105
News of Week	106
Army and Navy Notes	108

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THE next meeting of the Connecticut Civil Engineers & Surveyors Association, will be on September 5th, leaving New Haven via Steamer to Norwalk. Six papers have been prepared for the meeting.

WE have had numerous complaints from our subscribers concerning the non-arrival of Nos. 6 and 7 of the ENGINEERING NEWS. We have carefully examined into this matter and find that in each case these papers were mailed to their respective addresses as far as this office is concerned. We regret exceedingly this annoyance to our subscribers and to ourselves, and have made the deficiency good as far as we were able. But our editions of these dates are now exhausted.

The only explanation that we can offer is, that this being the vacation season among the mailing clerks in this city, it is possible that there has not been the usual care displayed in sending out the mails. The fault lies somewhere between the New York Post Office and the receiving office.

THE New York Board of Aldermen are having their little plans, concerning the Broadway Surface Railway, greviously interfered with. By certain arrangements among themselves and outside parties, referred to in our last issue, they voted away privileges, worth a million to the city, in defiance of law and public opinion.

Judge Donohue, of the Supreme Court, on the application of certain taxpayers, now enjoins the Board of Aldermen from taking any action or proceedings to override the veto message of the Mayor, until after the local authorities shall advise whether the act of 1884 is constitutional, and if it is, then the franchise is ordered to be put up for sale at public auction and sold to the highest bidder for not less than $1,000,000.

This is a very decided check, and according to the press, was most ungraciously received by the Board as an unwarranted and unusual interference with the rights, privileges and profits of a New York Alderman.

The minimum selling price, fixed by Judge Donohue is justified by the *bona-fide* offer of that sum by the President of the Cable Surface Railway Company to Mayor Edson.

English Locomotive Axles.

The London *Contractor* takes as the text for an editorial the recommendations of the jury that sat to enquire into the cause of the recent accident at Penistone. This jury recommended that "railway companies should address themselves to discovering some means of detecting flaws or imperfections in crank axles of railway engines."

The *Contractor* very pertinently asks the question—Why are crank axles used on railways? And in continuation of the subject says:—

"Many powerful engines are running with outside cylinders requiring only straight axles, and it must be patent to any body acquainted with the ticklish operation of forging, and with the insidious way in which flaws creep into smiths' work, that the form given to a forging is calculated to influence its character and quality. A simple configuration, such as a more or less cylindrical one of tolerably uniform thickness, is more likely to be exempt from defects in working or reworking than one where the continuity of the fibres is exposed to interruption by sudden changes in bulk or shape. Supposing, however, that a cranked axle is perfect when fitted to an engine, its form from the frequent bends cannot be that of maximum strength to withstand the shocks likely to be inflicted on it; nor will so much of its skin admit of the same ready inspection as a straight driving axle of ordinary pattern. In the Penistone accident, the fact of the engine having broken an axle some months previously suggested the idea that through violence, or other mishap, the frame may not have been perfectly true, and that the twisting of the axle by the centrifugal force grinding the wheel flange against the outer rail of the curve had to be encountered under conditions rendered extremely adverse by such possible malformation. At all events, as some people object to riding in cabs and coaches that have been at some time or other known to overturn, it is likely that many would decline being drawn to their destination by this particular locomotive if they could perchance identify it.

It is not reassuring to the traveling public to be told by so high an authority as Major Marindin that "a large number of crank axles break every year." Trains are increasing in weight as well as in speed, and it is not far from the truth to assert that lost time is often made up by fearless drivers on some lines at parts which are not adapted either from gradients, curves, construction, or condition for traversing at an abnormally quick speed."

Perhaps the best answer to the query propounded by the *Contractor* is, that the conservative English railway manager and engine-builder is slow to change from known bad forms to the proven good. The editorial admits that there is no necessity, except from precedent, for the continuation in use of the faulty type; that better forms exist, but with coach-bodies for passenger coaches, Costan lights for bell-cords, and an inadequate shield instead of an engine-driver's cab, the inside cylinder has been used for the generation past and will be used until John Bull realizes the fact that he is woefully behind the times. When this awakening will come is a matter hard to fix in date.

During the last year, according to railway statistics, nearly 250 accidents have happened in England from axle breakage alone, and in every case this axle was of the type known as the *crank-axle*, long ago banished from this country and fast disappearing from the Continent.

In every point, both theoretical and practical—with perhaps two exceptions—the engine with outside cylinders is superior to the inside cylinder type. The inside connected engine is more compact, it is true; it permits a greater appearance of simplicity by the questionable practice of covering up an actually complicated mechanism; it allows the use of outside frames, and consequent greater diameter of boiler, and width of firebox; there is less necessity for counterbalancing, since different portions of the reciprocating parts can be made to partly balance each other, and they are so situated that the unbalanced motion does not produce the rocking and twisting which is apt to occur in outside cylinder engines when running at high rates of speed. But these disturbances in the latter type can be almost entirely overcome by proper counterweighting, and every one at all familiar with the locomotive knows the liability to gather dirt, and the un-get-at-ableness of the moving parts, the difficulties of construction and repairs, of cleaning and oiling which render the machine with inside cylinders the bugbear of engine drivers and shopmen.

But the feature which most materially affects the travelling public is that of safety. And here it is evident that there is less liability to fracture when the 20,000 lbs. thrust of the connecting rod,—reversed six times a second,—is brought upon a crank-pin set in a web between the spokes of the driver and subjected only to shearing stress, than when it is received by a crank axle with 22 or 24 in. throw and 12 or 14 in. overhang. A rough calculation of these strains of torsion and those brought upon the axle by rounding curves at a high rate of speed, gives a resultant which leaves this awkward forging with a very small factor of safety even when without flaw. Moreover a loose or broken crank-pin has no worse result than making the cab too warm for the engineer's comfort, while a broken crank axle means derailment with all its possibilities of injury and death to hundreds of passengers In spite of all this, certain railroads in England go on building and buying engines of this type, and will doubtless continue so to do, until the government interferes to protect the public, or until some fire burns up the pattern loft and gives them an opportunity to change without extra expense.

The Severn Tunnel.

On August 9, the Institution of Mechanical Engineers, of England, visited the Severn tunnel, and the following is gathered from the account of their inspection of that work:

The total length of the tunnel is 4½ miles, one-half of which distance is actually under the Severn River. At the time of the tapping of the land spring, in 1879, which discharged 360,000 gallons per hour into the workings a short distance from the Monmouthshire Shore, a pair of dams, about 100 ft. apart, were erected after much time and trouble expended, shutting back the water and cutting the tunnel. These dams are still in position although excepting them the tunnel is driven from shore to shore. Sluices are fitted into the dams mentioned to control the flow of water and additional pumps are being erected. The quantity of water now raised is 11,000 gallons per minute, pumped by three Cornish and two Bull engines. Two more large Cornish engines have just been erected by Messrs. Harvey & Co., of Hayle. The seven pumps will have a capacity of about 55,000 gallons per minute.

At present a curved heading is being driven to connect the two parts of the tunnel and to enable the pumps to better handle the water so that this portion of the tunnel may be completed.

A news item in *Engineering* says that during the last six months 1,350 yds. of the tunnel have been completed, and 450 yds. arched. Out of a total length of 7,664 yds. about 5,050 yards of permanent tunnel have now been completed and a further length of 2,050 yds. has been arched. In anticipation of the completion of the tunnel the contract has been let

for doubling the Bristol and South Wales Union Railway from the junction of the tunnel railway to the main line near Bristol.

Explosives of the "Rack-a-rock" Type.

TRANSLATED FOR ENGINEERING NEWS BY GEO. J. SPECHT, C. E.

In connection with the class of explosives of which the recently introduced *Rack-a-rock* is a type, the following letter of Mr. Isidor Trauze, General Manager of the Nobel works, is of interest:

In November, 1873, Dr. H. Sprengel called attention to a new class of explosive substances which "during their manufacture and storage as well as during transportation are not explosive." He found that a large number of organic substances, having a high percentage of combustible matter, such as carbon, hydro-carbon, etc., furnish an explosive nearly as strong as pure nitro-glycerine, when mixed with fluids containing a high percentage of oxygen. He mentioned nitric acid as especially rich in oxygen; a large number of non-explosive organic substances are soluble in it and these mixtures form explosives of great power.

Sprengel mentions among these organic substances a series of nitrates, formed by nitrating carburet of hydrogen, as, for example, nitro-benzol. He points out the many advantages which result from the fact that the oxidizing ingredients are kept separate from the combustible agents up to the time when chemical connection shall take place, or only when the work requires it.

All these advantages do not need emphasizing, but, as Sprengel himself says, "there are some objections to the use of such explosives." In fact, anyone who has had occasion to operate with concentrated nitric acid will fully appreciate the difficulty attending its use to dissolve other substances, at the place where it is to be employed, and then attempting to make cartridges of the very explosive, caustic mixture, which effects the cartridge-shell as strongly as the acid itself.

But by this process the factory is actually transferred to the mine, tunnel or quarry, and the accidents in powder works, now comparatively rare, will thus become rarer still, for the works will not produce explosives, but the ingredients only, harmless when kept separate. The accidents, during transportation, will also be less frequent. But the accidents at the working places, where the harmless substances are mixed to form an explosive, will be increased a hundred-fold. The manufacture of the "explosive" is taken from the hands of experienced men and transferred to laborers and foremen totally ignorant of the chemical nature of the substances and their relations to each other.

An explosive of this class, called "Hellhofit," from its pretended inventor, Hellhof, of Berlin, has lately been introduced into Germany, ten years after Sprengel pointed out the principles.

PERSONAL.

HENRY VILLARD, the ex-Railroad President, proposes to make his future home in Berlin.

AT a meeting held recently in the hall of the Institution of Civil Engineers it was decided to erect in Westminster Abbey a memorial window to the late SIR W. SIEMENS. It was resolved, in order that the tribute should be of a truly representative character, to limit the amount of subscription to £1 1s. from each person.

THE Tremont House, Galveston, the largest hotel in Texas, is being entirely refitted with plumbing and drainage by the Durham House Drainage Co., under the supervision of Mr. W. Paul Gerhard.

The South Kensington Exhibition of 1885.

The exhibition which will be held at South Kensington, England, in 1885, is to be of so comprehensive a character that it will be difficult to find space for all the objects which are to be shown.

The exhibits which come under the head of engineering construction and architecture will suggest the range of the proposed exhibition. *Roads.*—Methods and materials for constructing and paving roads, cleansing roads and pavements; road-sweeping machines, rollers, apparatus for the removal of mud, snow, etc., water-carts and other means of watering. *Railways and Tramways.*—Construction, excavators and appliances used for earthwork and tunnelling, permanent way, rails, chairs, sleepers. *Bridges and Viaducts.*—Models, plans, and designs for arched, girder, suspension, trestle, and other bridges; apparatus used in construction. *Docks and Harbors.*—Models, plans, and designs for docks, harbors, piers, breakwaters, etc., submarine construction, diving apparatus, dredging machines; pile-drivers, screw-piles, coffer-dams, graving docks, "patent" slips, caissons, pontoons, floating docks, hydraulic apparatus for working dock-gates, etc., gridirons, buoys. *Light-houses.*—Methods of construction, appliances used in lighthouses and in lightships, fixed and flashing light apparatus, lamps, sound-signalling apparatus. *Rivers and Canals.*—Conservation and improvements of rivers; construction of canals; locks, lifts, and inclines; weirs. *Water Supply and Sewerage.*—Methods of collecting, pumping, storing, filtering, and distributing water; appliances for detecting and preventing waste of water; water-meters, water-fittings, filters; sewers, sewage disposal and utilization. *Reclamation, Irrigation, and Drainage of Land.*—Drainage (natural and artificial) of low-lying districts, embanking and warping land, irrigation works. *Testing Apparatus.*—Apparatus and instruments used in testing iron, stone, brick, concrete, cement, etc. *Military Engineering and Fortification.*—Military topography. *Materials Used in Building.*—Bricks and tiles, machines for making them; concrete, artificial stone, cement, materials, and appliances used in their production; asphalte, roofing felt, and other roofing materials, columns, girders, and other applications of metal in building; applications of terra-cotta to buildings; preservative and fire-resisting materials, paints, etc., for application to stone, wood, iron, etc., methods of applying the same. *Building Construction.*—Models and plans showing methods of construction, non-combustible constructions; labor-saving and other machines and appliances used in building, scaffolds, elevators; fittings and appliances used in building, shutters, blinds, lifts, bells, speaking tubes, etc. *Heating Ventilation, House Drainage, etc.*—Sanitary appliances, ventilators, cowls for chimneys, chimney-sweeping apparatus, apparatus for heating by steam, water, air, etc.; means of cooling air.

Wire Rope Transmission for Pumping.

A recent issue of the transactions of the *Societe de l' Industrie Minerale* contains the description of two small pumping plants at the Segur pit of the Montchanin colliery and the Orleans shaft of the Brassac colliery, France. Both are interesting examples of the employment of wire rope transmission for driving underground pumps by surface machinery. At the Segur shaft the hoisting engine is used for pumping at night, but especially during sinking, additional pumping is necessary, and this is done in the following way: An engine on the surface, 130 meters (426.5 feet) from the shaft, making 40 revolutions, drives a sheave making 360 revolutions a minute, the speed of the 12 millimeter (0.47 inch) rope being 22.6 meters (71.4 feet). The duty is 0.3 cubic meter (10.6 cubic feet) of water per minute from a depth of 135 meters (442.9 feet). The pumps are two single acting plunger pumps 200 millimeters (7.87 inches) in diameter, and 500 millimeters (19.7 inches) stroke, making 10.8 strokes a minute, and requiring theoretically 10.5 horse-power. The wire rope is kept taut by a sliding counterweight arrangement making a tension of 255 kilograms (562.1 pounds). The average life of the rope is 1900 working hours, during which 34,000 cubic meters (1,200,000 cubic feet) of water are raised.

At the Orleans shaft, the pumps were used to sink from a depth of 264 meters (866.2 feet) to a depth of 325 meters (1066.3 feet). They were driven by an old horizontal 350 by 1,000 millimeter (13.8 by 39.4 inch) engine, making 60 revolutions, driving the main sheave from which the rope was conducted into the shaft to two old Letestu pumps, 200 millimeters in diameter (7.9 inches), and with 660 millimeter (26 inch) stroke. Making 16 strokes, they were capable of lifting 0.5 cubic meter (17.7 cubic feet) of water. The rope was conducted underground over three sheaves, two of them gearing down to the speed of the pumps, while the third was used for the suspension of the weight to keep the rope taut. The sheave on the surface makes 200 revolutions, and the pump sheaves 312; the speed of the rope being 20 meters (65.6 feet). One rope lasted 73 days, the second 81 days, the total length being 590 meters (1935.8 feet) and its diameter 13 millimeters (0.51 inch). The wear of the ropes in both cases seems excessive.

A New System of Painting Iron.

A process on a new principle for protecting iron and steel from corrosion (especially when submerged) has been suggested by Mr. F. Maxwell-Lyte, F. C. S. The theory of the process is essentially electrical; and its utility is based upon the hypothesis that the oxidation of iron and steel is much accelerated by, if not wholly due to, galvanic action. The metal to be protected is first coated with one or two primings of an oxide of a metal electro-positive to iron, upon which any of the ordinary anti-fouling or oxide paints may be applied. These latter always contain the oxide of a metal electro negative to iron; and this oxide will consequently always be reduced, and the iron oxidized in time. The priming employed by Mr. Maxwell-Lyte is composed of oxide of zinc or magnesia, particularly the latter; and this not only protects the iron, but keeps it from contact with the outer coat. It is claimed that something of this kind has always been even partially sucessful; but that the guiding principle—the use in the first place of material electro positive to iron—has been overlooked. Red lead as a priming does fairly well for a time; because though lead is electro-negative to iron, it is only slightly so. Better protection is assured by the use of distinctly basic material.

Berlin Sewerage.

Berlin has just completed its improved sewer network. In the period comprised between April 1, 1882, and March 31, 1883, the fourth and fifth radial sewer networks of the inner town of Berlin were completed. The five networks now in work comprise the whole plan of the new system, and will serve 10,549 houses. The quantity of effluent water forwarded to the sewage farms is on an average 71,482 cubic metres daily. The working cost amounts to 502,116 marks (£25,155), divided into the following items:—General management, £1,370; pumping station, £14,124; and street drains and house connections, £9,660. Nine sewage farms are now in work around Berlin, to deal with the existing needs of the city, and others are in prospect for the near future.

TURNOUTS:

Exact Formulæ for their Determination, together with Practical and Accurate Tables for Direct use in the Field.*

BY W. B. PARSONS, JR., C. E., ROADMASTER NEW YORK AND GREENWOOD LAKE DIVISION, ERIE RAILWAY.

(*Continued from page 92.*)

Tables Nos. 5 to 13 give two sets of switch timbers for each frog. In the one set the ties are to be spaced forward from the head-block, at 18 in. centres, in the other at 22½ in. centres; and both are calculated to correspond with a cross tie 8 ft. long, to have their ends carry out the turnout curve and to extend beyond the frog-point until ordinary cross ties can be put in the main track and siding without interfering. To obtain a bill of switch timber for double turnout, it is evident their number must equal those of a single turnout for same frog; and to find their lengths, add to each timber of a single turnout the amount it exceeds the standard cross tie in length.

For cross-overs the set is dependent on the distance between the tracks. With that known, the bill can readily be written out so that the cross-over and parallel tracks rest upon the same through-and-through timbers between the frog-points and for such a distance on each side of the frog-points that the turnout timbers and the cross ties of the other parallel track can be put in place separately.

To each set as given a head-block is to be added of such size as is necessary.

For "point" switches it is evident that the given tables lack the ties for the distance of the length of the moving-rail. These usually depend on the form of switch used, each type requiring special timbers in that space. All of these bills can readily be changed to correspond in length to cross ties other than 8 ft. by adding the difference.

TO BE CONTINUED.

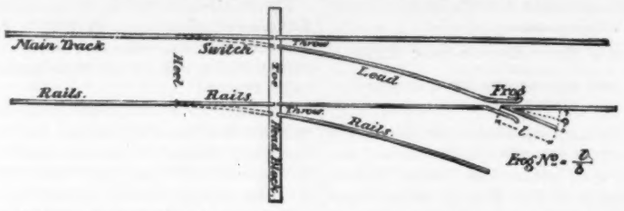
Table No. 10.—Bills of Switch-Timbers for Frog No. 10.

18-*in. Centres.*		22½-*in. Centres.*	
PIECE.	LENGTH.	PIECE.	LENGTH.
2	6″ × 8″ × 8′ 6″	2	6″ × 8″ × 8′ 6″
2	" 8′ 7″	1	" 8′ 7″
1	" 8′ 8″	1	" 8′ 8″
1	" 8′ 9″	1	" 8′ 9″
2	" 8′ 10″	1	" 8′ 10″
1	" 8′ 11″	1	" 8′ 11″
1	" 9′ 0″	1	" 9′ 0″
1	" 9′ 1″	1	" 9′ 1″
2	" 9′ 2″	1	" 9′ 2″
1	" 9′ 3″	1	" 9′ 3″
1	" 9′ 4″	1	" 9′ 4″
1	" 9′ 5″	1	" 9′ 5″
1	" 9′ 6″	1	" 9′ 6″
1	" 9′ 7″	1	" 9′ 7″
1	" 9′ 8″	1	" 9′ 8″
1	" 9′ 9″	1	" 9′ 9″
1	" 9′ 10″	1	" 9′ 10″
1	" 9′ 11″	1	" 9′ 11″
1	" 10′ 0″	1	" 10′ 0″
1	" 10′ 1″	1	" 10′ 2″
1	" 10′ 2″	1	" 10′ 3″
1	" 10′ 3″	1	" 10′ 5″
1	" 10′ 5″	1	" 10′ 7″
1	" 10′ 6″	1	" 10′ 8″
1	" 10′ 7″	1	" 10′ 10″
1	" 10′ 9″	1	" 11′ 0″
1	" 10′ 10″	1	" 11′ 2″
1	" 10′ 11″	1	" 11′ 4″
1	" 11′ 1″	1	" 11′ 5″
1	" 11′ 2″	1	" 11′ 7″
1	" 11′ 4″	1	" 11′ 9″
1	" 11′ 5″	1	" 12′ 0″
1	" 11′ 7″	1	" 12′ 2″
1	" 11′ 9″	1	" 12′ 4″
1	" 11′ 10″	1	" 12′ 6″
1	" 12′ 0″	1	" 12′ 8″
1	" 12′ 2″	1	" 12′ 10″
1	" 12′ 3″	1	" 13′ 1″
1	" 12′ 5″	1	" 13′ 3″
1	" 12′ 7″	1	" 13′ 5″
1	" 12′ 9″	1	" 13′ 7″
1	" 12′ 10″	1	" 13′ 10″
1	" 13′ 0″	1	" 14′ 0″
1	" 13′ 2″	1	" 14′ 2″
1	" 13′ 4″	1	" 14′ 4″
1	" 13′ 6″	1	" 14′ 7″
1	" 13′ 7″	1	" 14′ 9″
1	" 13′ 9″	1	" 14′ 11″
1	" 13′ 11″	1	" 15′ 1″
1	" 14′ 0″	1	" 15′ 4″
1	" 14′ 3″	1	" 15′ 6″
1	" 14′ 4″	1	" 15′ 8″
1	" 14′ 6″	1	" 15′ 10″
1	" 14′ 8″	1	" 16′ 0″
1	" 14′ 10″		
1	" 15′ 0″		
1	" 15′ 1″		
1	" 15′ 3″		
1	" 15′ 5″		
1	" 15′ 7″		
1	" 15′ 9″		
1	" 15′ 10″		
1	" 16′ 0″		
66	767′.6″ lin. = 3070 ft. B.M	52 pieces.	618′.1″ lin. = 2472. 3 ft. B. M

Table No. 11.—Bills of Switch Timbers for Frog No. 11.

18-*in. Centres.*		22½-*in. Centres.*	
PIECE.	LENGTH.	PIECE.	LENGTH.
2	6″ × 8″ × 8′ 6″	2	6″ × 8″ × 8′ 6″
2	" 8′ 7″	1	" 8′ 7″
2	" 8′ 8″	1	" 8′ 8″
1	" 8′ 9″	2	" 8′ 9″
2	" 8′ 10″	1	" 8′ 10″
1	" 8′ 11″	1	" 8′ 11″
1	" 9′ 0″	1	" 9′ 0″
2	" 9′ 1″	1	" 9′ 1″
1	" 9′ 2″	1	" 9′ 2″
1	" 9′ 3″	1	" 9′ 3″
1	" 9′ 4″	1	" 9′ 4″
1	" 9′ 5″	1	" 9′ 5″
1	" 9′ 6″	1	" 9′ 6″
1	" 9′ 7″	1	" 9′ 8″
1	" 9′ 8″	1	" 9′ 9″
1	" 9′ 9″	1	" 9′ 10″
1	" 9′ 10″	1	" 9′ 11″
1	" 9′ 11″	1	" 10′ 1″
1	" 10′ 0″	1	" 10′ 2″
1	" 10′ 1″	1	" 10′ 3″
1	" 10′ 2″	1	" 10′ 5″
1	" 10′ 3″	1	" 10′ 6″
1	" 10′ 4″	1	" 10′ 8″
1	" 10′ 5″	1	" 10′ 9″
1	" 10′ 6″	1	" 10′ 11″
1	" 10′ 8″	1	" 11′ 1″
1	" 10′ 9″	1	" 11′ 2″
1	" 10′ 10″	1	" 11′ 4″
1	" 10′ 11″	1	" 11′ 6″
1	" 11′ 1″	1	" 11′ 8″
1	" 11′ 2″	1	" 11′ 9″
1	" 11′ 3″	1	" 11′ 11″
1	" 11′ 5″	1	" 12′ 1″
1	" 11′ 6″	1	" 12′ 3″
1	" 11′ 8″	1	" 12′ 5″
1	" 11′ 9″	1	" 12′ 7″
1	" 11′ 11″	1	" 12′ 9″
1	" 12′ 0″	1	" 12′ 11″
1	" 12′ 2″	1	" 13′ 1″
1	" 12′ 3″	1	" 13′ 3″
1	" 12′ 5″	1	" 13′ 5″
1	" 12′ 6″	1	" 13′ 7″
1	" 12′ 8″	1	" 13′ 9″
1	" 12′ 10″	1	" 13′ 11″
1	" 12′ 11″	1	" 14′ 2″
1	" 13′ 1″	1	" 14′ 4″
1	" 13′ 2″	1	" 14′ 6″
1	" 13′ 4″	1	" 14′ 8″
1	" 13′ 6″	1	" 14′ 10″
1	" 13′ 7″	1	" 15′ 0″
1	" 13′ 9″	1	" 15′ 2″
1	" 13′ 11″	1	" 15′ 4″
1	" 14′ 0″	1	" 15′ 6″
1	" 14′ 2″	1	" 15′ 8″
1	" 14′ 4″	1	" 15′ 10″
1	" 14′ 5″	1	" 16′ 0″
1	" 14′ 7″		
1	" 14′ 8″		
1	" 14′ 10″		
1	" 15′ 0″		
1	" 15′ 1″		
1	" 15′ 3″		
1	" 15′ 5″		
1	" 15′ 6″		
1	" 15′ 8″		
1	" 15′ 10″		
1	" 16′ 0″		
72	834′.10″ lin. = 3339.3 ft. B. M.	58	674′.7″ lin. = 2698.3 ft. B.M.

Frog Diagram.—Giving Nomenclature of Parts.



The above diagram shows the various parts of a turnout with their respective names. Th length l of a frog, when used in computing the frog-number, is the length of the middle lin from the *true* point to heel, shown dotted in the diagram; b is the total breadth at heel. Th frog-number is equal to $\frac{l}{b}$

EXPERIMENTS on an extensive scale have been made by the Dutch Government to ascertain the strength of iron and steel girders. The soft steel girders proved to be 22 per cent. and the hard steel girders 66 per cent. stronger than the iron girders. It was pretty well established that the strength of steel girders is about the same for the two flanges if they are made alike in section.

CORRESPONDENCE.

Corrosion of Cast-Iron Pipes.

Special Correspondence Engineering News.

EDITOR ENGINEERING NEWS:—To put aside urgen work for merely personal discussion, or to continue discussion with parties who indulge in the language of July 19th, or the very patronizing advice of August 9th, is not etiquette among old chief engineers; but as a subject of practical importance has been broached, and as ENGINEERING NEWS justly complains that proper records of experience are not made by us, and as an answer to the Kentucky Company involves some historical data on foundry work, and it is desirable to overcome their reluctance to furnish data I am induced to continue.

When appointed Assistant Surveyor of Albany, in 1847, Geo. W. Carpenter, Esq., a favorite pupil of Prof. Joseph Henry, being chief in a department which controlled all the public works of the city, the question of water supply was in active discussion, and a great deal of the preliminary work came under our care. In 1850, the work was formally commenced under our professional mentor, Hon. Wm. J. McAlpine.

The city was then supplied, in part, by the Albany Water Works Company, which continued a supply, begun in 1795, using at that time wood logs for aqueduct and distribution, in about 14 ft. lengths, bored 3, 4 and 6 in., and jointed with spigots and faucets, or cast-iron thimbles, said to be made of Salisbury iron. Though ordinary 9 ft. cast-iron pipes were gradually substituted, many of these logs were in use up to 1850; I saw them occasionally taken up, and the state of the thimbles, well rusted but not choked up with tubercles, bore important witness to the theory that quality of metal and foundry work exert a very important influence on corrosion.

Among other questions carefully studied was that of piping. In 1842, Wm. McC. Cushman, City Surveyor, advocated a pipe aqueduct supply from Cohoes, proposing 17 in. mains of high grade iron and light thickness, one-quarter inch thick in lengths of 15 ft., their joints laid in zinc to prevent oxidation. Three of these points were considered impracticable the length was also seriously objected to by foundry men. The new supply was laid with 9 ft. lengths.

I spent considerable time with Mr. Wm. McCammon, Superintendent of Townsend's Furnace, a shop of high rank in locomotive history, and other work, and was specially interested in the successful casting of a number of long and large diameter columns for the State Street Bridge, an experience which satisfied me that there was no practical difficulty in casting pipes to lay 12 ft.; but it was not until 1858-9 that the contractor for the Brooklyn works, acting under my advice, succeeded in getting 12 ft. mains regularly under contract here, and not then until an importation of 36 in. mains of 12 ft. had been made from Glasgow. In 1860, the Croton Department made its first contract for 12 ft. mains, with the Warren Foundry, and specifications from this time required all mains of and over 20 in. diameter to be cast vertically, hub down, intended to be so set in the pits in circles, as to obviate unequal cooling.

In 1851-2, in the Engineer Corps of the Navy, I had continuous foundry, shop and ship work in charge, and several months sea service as watch engineer, and was also inspector of the foundry and other work for the California Section Dry Dock, built in New York by Secor & Co., and shipped to Mare Island for erection.

On resigning, I took charge of the construction at the Brooklyn Navy Yard as principal Assistant Engineer. In addition to the completion of the Dry Dock Wings, and the erection of various buildings and their machinery, the construction of fully equipped steam engine works for the Navy was adopted and commenced. The large Dry Dock machine shop was fitted up and a large foundry built and in great part equipped under my charge. Mr. Ames, of the Chicopee Works, was one of our contractors, and I had free access to that splendid establishment as well as his personal counsel; I also had drawings of the best European shops. I am not entitled to credit for the superb works

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of that yard, as my old corps has completed them, but, at least, *quorum pars minimum fui*.

In making all the plans and specifications, and putting the Brooklyn Water Works under contract, as Chief Engineer, in 1856, I had to make a careful study of the state of hydraulic engineering, with us, up to that date, and improve on it as I could; and that work, more than any other, in all its details, has regulated all subsequent supplies. In signing the contract for a fixed sum of $4,200,000 (a case without precedent at that day) where implicit reliance was required on my judgment, one of the firm of H. S. and C. F. Welles at the last moment refused to take such a risk, and his name was added without his consent very much to his subsequent satisfaction.

My specification covered two single acting Cornish pumping engines of 14 ft. stroke and 90 inches base; so strenuous was the opposition of the West Point and other foundries to castings of that size, that it tended strongly to the subsequent adoption of double acting cylinders of 10 ft. stroke and 90 in. base, as built by Woodruff and Beach, at Hartford. I did not concede this, myself, and it was not long before the "Metropolis" carried a larger cylinder on Long Island Sound, while the "Great Eastern" in 1860, had cylinders of 14 ft. stroke by 74 in. The engines built were the first under guaranteed contract duty; each was more powerful by 16 per cent. than any other pumping engine then in use; under careful test No. 1 showed about 7½ per cent. friction; as my combination of all the merits of the Cornish engines with double action proves, I think we showed some knowledge in those days of castings and machinery.

As to pipe specifications and laying pipe, I began at the yard in 1853, and ended at Watertown in 1878, making them for various prominent cities in the interim. Their present language is remarkable, chiefly in various clauses, for its literal copy of the Brooklyn specifications of 1859, when coal-tar varnish and vertical castings of and above 20 in. were accepted laws.

As to concentric forms, absolute line and freedom from all defects, they are "cast-iron" ordinances; as to quality of metal, rather elastic. My request for extracts in the Newport case was for comparison, rather than information, and I was and am curious to know how the claim of absolute perfection of work made, is endorsed by the inspectors note books, as to special methods of test, when we are told that no pipe cast by them has been rejected, apparently sound in leaving the mould.

As to the key* of the whole question, the actual analysis of the pipes themselves, prudish modesty is out of place. There is no secret to tell. We know what it is in our prominent cities, and its important bearing on exposure to corrosion, as occasion has put it on record. Let us know what it is at Newport, and we can form an opinion on the high claims made.

Whether a pipe, imperfect in quality and construction of metal is cast vertically or on an incline, is not essential as a cause. I have known an honest inspector to reject 58 of 423 20-in., and 14 of 250 30-in. pipes, vertical, dry sand castings, in the press, beside others rejected on sight; add to the blisters, sand-holes, shrinkage cracks, air cells, or cold shafts, as contingencies, soft and impure metal, and we put this question in its proper light for study.

SAMUEL MCELROY.

Magnetic Test for Flaws in Iron.

Special Correspondence Engineering News.

CANAAN STREET, N. H., Aug. 21, 1884.

EDITOR ENGINEERING NEWS.—There is an implied query in Mr. W. Williamson's letter on page 82 of your last issue, the answer to which I can partly supply.

The discussion referred to in the Transactions of the American Society of Civil Engineers is very brief. It was published, if I remember rightly, about five years ago.

Your correspondent was right in assigning the original experiments to Lieut. Saxby, R. N., but wrong in crediting him with the use of an electric current. Saxby's method is chiefly applicable to short bars, and was recommended for testing car axles. The bar to be tested was tipped into the normal position of the dip needle and was struck a sharp blow. A compass needle was than passed along near the bar. A flaw in the iron caused a *sudden* deflection of the needle.

Saxby's experiments may be easily repeated with small rods. A half-inch bar two feet long is suitable for the purpose. A compass such as is worn on watch chains affords the best needle for experiments on a small scale. The flaw to be detected may be improvised with a file. If a hole be drilled in the test bar and then plugged ever so carefully with a rivet or screw, the needle will point it out as a flaw of very decided character.

The method of making an electro-magnet of the bar to be tested was devised so far as is now known by Mr. A. Herring, about 1870. His experiments which were carefully worked out, were begun at Crown Point, N. Y., and continued for some months, about 1874, in the shops of the East River Bridge. In experimenting on the cable wire, Mr. Herring pulled the wire through a small helix charged with a current from two cups of a Watson battery. About two feet beyond the helix was a block of wood through which was a hole which would just permit the wire to pass freely. On the block was mounted a dip needle, counterpoised so as to be nearly horizontal when at rest. The sole object of the wooden block was to maintain a uniform distance between the needle and the wire. In Mr. Herring's hands the test was one of exceeding delicacy. Flaws which impaired the strength of the iron not more than one-half of one per cent. were readily detected and *measured*. The measurement implied, of course, a previous knowledge of the ultimate strength of the perfect wire as afforded by the testing machine.

A peculiar form of helix was devised for application of this method to iron plates. The different forms of apparatus used were fully described in Van Nostrand's Magazine some eight or nine years since. The inventor died soon after securing a patent for his process.

An interesting lecture room experiment is afforded by employing either Saxby's or Herring's method in connection with the magic lantern. A vertical lantern, a watch charm compass and a few feet of large wire complete the outfit. If the wire happen to be pure iron a helix and battery may be necessary; but if a minute quantity of carbon be present the touch of a magnet or a slight rap on the wire when held in the direction of the *Dip* is sufficient to charge it for the purpose. A notch sufficiently large to be seen in the projection on the screen, should be filed to represent the flaw.

Respectfully Yours,

GEO. W. PLYMPTON,
M. Am. Soc. C. E.

*If their pipes show 17,000 to 20,000 lbs. tensile strength per square in., some of them have been proved in the usual way, by rupture, as the record will show; such notes are of paramount interest.

A Curious Water Works Incident.

August 25, 1884.

EDITOR ENGINEERING NEWS: The citizens of the village of London, Madison Co., O., voted upon the question of Water Works August 23, 1884, defeating the enterprise two to one. In all probability this signal defeat was caused, not so much by the people being adverse to Water Works, as to the fact that there was an old grist mill in the problem that is situated some three miles in the country, the water power of which is largely supplied by springs. The owner of this old mill was the prime mover—head and front—of this Water Works improvement. The mill and water privilege were to go in as stock or otherwise. The old mill was to do the pumping (in dry weather the farmer must wait until a head gathers before his grist can be ground) forcing this water, after it had served the mill, three miles through a main to the users at London. This being embodied in the ordnance we think largely caused its failure.

J. ARNETT.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

(*Continued from page 94.*)

DCLXXII. OCONTO, WIS.

Oconto, Wisconsin, in lat. 44° 50′ N., long. 88° W., is on Green Bay at the mouth of the Oconto River. Settled in 1855, it was incorporated a city in 1868.

Water-works were built by a private company in 1883, after plans of P. W. Freeze, taking the supply from the river, the water being pumped by a Knowles pump of 7½ in. steam and 5 in. water cylinder and 10 in. stroke to a reservoir having a capacity of 32,000 gallons and an elevation of 50 ft. above the city.

Distribution is by 1½ miles of Wyckoff wood pipe, with 4 fire hydrants, 1 gate and 20 taps. Service pipes are of wrought-iron. The hydrants are for private use only.

The population, in 1880, was 4,171, it is now said to be 5,000.

The capital stock of the company is $10,000.

The cost of the works has been $4,000.

A. Cole is President and Chas. Hall, Vice-President.

DCLXXIII. PARIS, ONT.

Paris, Ontario, Canada, in lat. 43° 5′ N., long. 80° 30′ W., is situated in the valley between Grand River and Smith's Creek.

It was incorporated a village in 1850 and a town in 1856.

Water-works were built by the town in 1883, after plans of A. Ware, C. E., and under the superintendence of J. A. Bell, C. E., and W. Larery, C. E., taking the supply from a large spring one mile west of the town on Smith's Creek. The water is pumped by a steam pump made by Northey & Co., Toronto, to a reservoir 136 ft. square at the top and 100 ft. square at the bottom, and having an elevation of 140 ft. above the lower part of the town.

Distribution is by 4 miles of cast-iron pipe of 8 to 6 in. in diameter with 25 fire hydrants. The population in 1880 was 3,173.

The works have cost $31,448. The bonded debt is $30,000 at 6 per cent.

Hon. C. Whitlaw is Chairman of the Water-works Committee.

No further information is given.

WATER.

THE trial of the Faribault, Minn., Water Works was an entire success, showing the pressure from the reservoir to be all that is desired.

THE Richmond, Ind., Water Works are not nearly completed as reported in this column last week; one-third of the pipe is laid, but work has not commenced on the pump house or reservoir.

DR. PEHL, of St. Petersburgh, has discovered that bacteria growing in pipes, etc., may be destroyed by the setting up of centrifugal motion in the water. Experiments on very foul water lasting an hour showed a lessening of 90 per cent. of these animalcule.

FROM a recent report from the president of the Wooden Pump Manufacturers' Association of the United States, we learn that the number of wooden pumps manufactured annually in the United States varies from 100,000 to 200,000, the latter figure being reached in 1881. The amount of wood in a pump is, on an average, from 40 ft. to 50 ft.; so that the amount of poplar going into consumption in this line is from 8,000,000 ft. to 10,000,000 ft. per year.

THE *Iron Review* of Buffalo, says, that the Eddy Valve Company, of Waterford, N. Y., who secured the contract for 1884 for supplying the city with water main valves, have recently constructed one for a 36 in. pipe, and its arrival at the depot and subsequent removal through the streets to its destination attracted much attention. It weighed 8,000 pounds, and was 8 ft. in height. Those who examined it, and were competent to give an opinion, say it was a fine piece of mechanical work. The Eddy Valve Company are the parties who supplied the great gate valves for the Niagara Hydraulic Power Company, at Niagara Falls, probably the largest valves of the kind in this section of the country.

THE Peck, Stow & Wilcox Co., of Southington, Conn., has sued the City of Meriden, to recover $25,000 damages. They give as cause for the suit the late construction of a canal from the water-shed north of the city to the reservoir, claiming that by this action their water power is interfered with. The city answers that the canal is only useful during the spring when the factory pond of the plaintiff is running over, and further says that the real origin of the suit is the stoppage of a leak of 300,000 gallons per day in the dam of the city reservoir. An interesting legal controversy is expected.

THE following were the bids received and opened on the 28th for the construction of the Red Bank, N. J. Water Works:

Wm. John J. Smith, Spring Lake, N. J., bid $53,000 as per specification; price $300 per foot of well below 64 ft.

Edward Freel, Brooklyn, N. Y., bid $54,500 as per specification; price $150 per foot of well below 64 ft.

John E. Holliday, Jersey City, N. J., bid $43,400 as per specification; price $200 per foot of well below 64 ft.

J. M. Low, Kingston, N. Y., bid $39,900 as per specification; price $350 per foot of well below 64 ft.

Southwark F'd'y & M. Co., Philadelphia, bid $41,975 as per specification; price $40 per foot of well below 64 ft.

Wm. Richardson & Wm. Farrier, Bound Brook, N. J., bid $39,700 as per specification; price $275 per foot of well below 64 ft.

E. T. Field, Red Bank, N. J., bid $51,893 ⅓ as per specification; price $158 per foot of well below 64 ft.

MILWAUKEE has 101 miles of water main. The West Side pumping engines pumped on an average 804,408 gallons per day during 1883, giving a duty of 44,000,000 lbs. The North Point engines, pumped 14,788,701 gallons per day, with a duty of 83,000,000 lbs. The works are under the general supervision of Mr. G. H. Beuzenberg, City Engineer. * * * Last summer the city of Milwaukee invested $3,30000 in 130 water meters. The consumption of water from the 130 service pipes to which these meters were attached has been reduced to 59 per cent. of what it was during the first month of their use, while the amount of rates paid has been raised 74 per cent. By the use of the Bell waterphone 337 leaks and 117 cases of willful waste have been discovered and remedied. As a result of the above an actual reduction in consumption representing a cash saving of $2,000,00 in coal has been effected in the face of an increase in number of consumers.

ONE hundred and eleven new services have been put in by the Water Department of Malden, Mass., the present year, and over 6,000 ft. of main pipe laid.

NEGOTIATIONS which have been pending between the Holly Water Works Co., and the citizens of Ashland, Minn., were concluded on August 16. This company has entered into a contract to complete a full system of water-works at a cost of $65,000. The capacity of the pumps will be 2,000,000 gallons per day, and forty hydrants will be located at various points for fire purposes.

MR. L. H. GARDNER, Secretary of the New Orleans Water Works Company, has invented a method of clarifying river water. His description of it is as follows: "It has long been known that iron in all its forms, from ordinary scrap iron up to the various solutions of iron known to chemists, will clarify water. The trouble has been to give a clear water result and at the same time to eliminate from that result every feature that the investigation of the chemist or that every day use could criticize. I have used a solution of iron, the result of empirical experiments, the use of which does not develop any objectionable feature or characteristic whatever. It precipitates matter held in suspension in the water and goes with it to the bottom of the tank or basin. The water thus clarified presents no feature or characteristic it did not possess before, except its crystalline appearance.

"St. Louis has very large settling basins, four in number, with an aggregate capacity of some 70,000,000 of gallons. Our reservoir has also four basins, but their total capacity is less than 4,000,000 gallons. I wanted to test my method upon the largest scale possible. To this end I consulted Col. T. J. Whitman, the water commissioner of St. Louis, a disciple of Kirkwood, and one of the most eminent engineers and water works men in the country. His interest in the matter led him to invite me to St. Louis and to tender me the use of one of his settling basins for the purpose of an exemplification on a large scale.

"The basin assigned me could not be drawn entirely clear of water. It contained, on its delivery, about 3,250,000 gallons of muddy water. To this we added over 9,500,000, making a total of over 12,750,000 gallons.

"It required six hours of steady pumping by the ponderous machinery of the St. Louis works to accomplish this, lasting from 9 A. M. to 3 P. M. We had not been at work much more than an hour, before the water at the further end of the basin, 600 ft. distant from the inflow, could have been delivered in a much clearer condition than the average city supply. Three hours after the pumps ceased work on our basin the water presented a contrast to that in the contiguous basins which was highly complimented by the Mayor of St. Louis, by the water commissioner, his assistant and others who witnessed it. At sunrise next morning the water was clear as crystal.

"The solution of iron was poured from a pitcher by a man standing over the supply pipe in a proportion which had been calculated of one quarter of a pound of the solution to 8,500 pounds or 1,000 gallons of water. 'You see,' added Mr. Gardner, 'that the proportion is practically infinitesimal, and even strychnine in such a dilution would be, I imagine, harmless.'

There now remains the investiflation of the chemist nd his comparative qualitative and quantitative analysis. This has been promptly ente.ed upon. If intelligently conducted, as I have no doubt it will be, I have no doubt of a favorable report. This, in the mind of Col. Whitman, the water commissioner, seemed to be the only thing needed to demonstrate the entire success of the system. The cost of this method is anywhere from three-quarters of a cent to a cent and a quarter per 1,000 gallons. The cheapest method of *filtration* in the United States, as far as I know, is over three cents per 1,000 gallons, and this with irregular results."

Mr. Gardner showed some of the water clarified here by this process, which had been kept in a five-gallon demi-john since 1883. It was in perfect condition, clear as crystal, pure and sweet to the taste. That water has been analyzed by Dr. Joseph Jones, Prof. R. N. Girling and Prof. C. F. Chandler, of New York, who have pronounced it pure and potable.

NEWS OF THE WEEK.

Miscellaneous.

THE contract for erecting the new jail at Orlando Fla. has been awarded to Mr. G. Lamoyne for $4000.

A HYDRAULIC grader is at work deepening the channel of the Mississippi at West Pass near Vicksburg. Two 2 in. streams are discharged against the bottom of the channel from pipes led underneath the water.

MAYOR LOW has signed the grant to the Brooklyn and Long Island Cable Railway Company. This road, when built, will give the Long Island Railroad Company a connection with the Brooklyn Bridge and also the South Ferry.

THE St. Paul and Minneapolis Street Railway Co. will send a representative to study the working of the Cleveland electric railway, with the intention of adopting that system if the report is sufficiently encouraging.

A FRENCH inventor, Capt. Renards, claims to have succeeded in getting a balloon so thoroughly under control that it can be driven in any direction, even against the wind.

THERE are now five powerfull dredges at work in Lynn (Mass) Harbor, on the Government improvements. The New England Dredging Company put its machines at work at Breed & Holder's wharf.

THE contract for labor and materials for completing the walls of the superstructure of the Baltimore Post Office has been awarded to Gill and McMahon, of Baltimore, at their bid of $108,235.

A NUMBER of railroad men assembled at the City Point Works, Boston, to witness the working of a new wrecking car built by Mr. Hamson Loring. It has many improved appliances designed to give it stability and ease of working. Eighteen tons can be lifted by the crane, which commands a reach of about 30 feet on each side of the track.

SPEAKING about the Congo enterprise, recently, Mr. Stanley said that the chief object of his present programme is the construction of a railway from the mouth of the Congo, or at least from the head of tidewater navigation, to a point on the river above the cataracts. By this means he hopes to secure the whole trade of the country watered by the Congo, and bring it down to the coast.

THERE are now about a dozen bridges across the Thames at London, and the corporation has just decided to build another. Two centuries ago London bridge was the only one, and the bold proposition to throw across another as far up as Putney was kicked out of the House of Commons. One statesman went so far as to urge that the second bridge would be the end of London's prosperity.

BIDS were opened at the office of Col. Wm. P. Craighill, U. S. A., in Baltimore on August 25, for the foundation, pier, and abutment of a moveable dam, at Lock No. 6, Great Kanawha River Improvement. The bids were as follows:—Harold McDonald, Pittsburg, $102,060.-50; Keefer & Dull, Lewiston, Pa., $136,102.50; M. D. Burke, Cincinnati, O., $123,160.00; J. H. Wingate, Wytheville, Va., $128,990.00.

THE commissioners appointed by the Court to let the contract for building the levee, etc., in connection with the Grassy Lake drainage scheme, in the State of Illinois, are about ready to receive bids. A number of St. Louis contractors have already investigated the matter and the firm of Quigley & Concannon has manifested considerable interest in it. The commissioners intend to push it through in about three months. The financial prospect is pleasing. The land has been purchased at an outlay of about $1.00 per acre. It can be drained at an expense of $10 per acre, which will be fully covered by the first year's crops. When drained the land will be worth fully $40 an acre.

PARTIES with whom the Government contracted a number of years ago to make surveys of public lands in Dakota, made returns of plats, etc., without really making the surveys. The result has been great confusion in that region. Settlers have taken and located upon lands in accordance with the fraudlent surveys, and now the fraud of the surveyors is developed by complications arising. Instead of doing the work, the old contractors simply looked at the lands, drew lines, made field notes, etc., and sent the work to the department. The Government had no means of knowing that the pretended survey was a fraud, and it proceeded upon it in good faith. Now the boundary lines of different sections are complicated, titles confused etc.

NEW Hampshire is not behind Texas in the new industry of hunting for buried treasures. Thomas Simmons, the contractor for steam dredging, who has lately completed work for the government at Dover and in the Lamprey River, commenced operations on Saturday to unearth, if possible, the much-noted treasure said to be buried at Gew Castle, near the new bridge, close by the Wentworth House. Mr. Simmons, who is under contract with Boston and other parties who lay claim to and have for years professed great faith that such wealth is hidden in that vicinity, has the steam dredger Little Giant at work over a spot where some person's divining rod says the treasure is located. The contractor is paid every night for the work done through the day. His operations attract much attention from an incredulous public.

A CAR on the Missouri Pacific has a thirty light Weston dynamo, and accompanying plant on the incandescent principle. The current can be transmitted from this car to others by means of the bell cord, saith the correspondent responsible for the above facts.

AT a recent meeting of the Western Associa- of Engineers, in Chicago, the committee on constitution and by-laws submitted a partial report, which proposes among other changes to receive as members persons engaged in any grade of engineering or the manufacture of anything that enters into engineering; also providing for the admission as contributing members of any persons who should wish to join. The committee were instructed to have their report completed to present at the next meeting. Commissioner Cregier made a suggestion, which met with general favor, to the effect that the association bring itself into sympathy with the Chicago Warner school by allowing its graduates to become members without the payment of the entrance fee.

LEWIS'S system of gas lighting has been introduced with brilliant effect on one of the platforms of the railway station at Euston, London. Its principle depends upon the mixture of atmospheric air under pressure with a certain proportion of ordinary illuminating gas, the light being producedthrough the incandescence of a platinum wire gauze cap which forms the apex of the burner. There being no flame the light is perfectly steady in wind and rain, and no lanterns or glasses are requisite. The quantity of gas consumed by this system is said to be 17 per cent. less than what is required by the common system, although the candle power is twice as great as that yielded by the latter. A modification of the Lewis burner, which will not require compressed air, is to be made for house lightning.

A CANTILEVER BRIDGE AT LOUISVILLE.—A second bridge over the Ohio, between Louisville and New Albany, is an assured fact. The bridge is being built by the Union Bridge Company, of New York. The bridge will be on the same plan as one recently erected near Niagara Falls, and it will be 2,452 ft. long, with two channel spans. The first of these will be over the canal, from between Thirty-second and Thirty-third streets to the lower end of Sand Island, and will be 483 ft. in length. The other channel span on the Indiana side is to be 480 ft. in length. The bridge will be 54 ft. wide and there will be two wagon tracks and two railroad tracks, besides a passage way for foot passengers on either side. The bridge, it is estimated, will cost $1,600,000.

THE Galvin brass and iron works, incorporated under the manufacturing company's act on the 8th inst. filed its articles in the county clerk's office of Detroit, Mich., Aug. 16. Its name is as above stated, its term is to be thirty years, its headquarters will be in Detroit, and its object is the manufacture of all kinds of brass and iron ware. Its capital stock is $100,000, divided into 4,000 shares of $25 each, and the incorporators are Francis Palms, M. W. O'Brien, H. W. Skinner, F. F. Palms, Thaddeus Galvin, John Galvin, John W. Strackbein, John Collins, W. S. Armitage and J. T. Keena.

THE city of Providence, R. I., is building an iron bridge over the Sekonk River about 1,000 ft. further up-stream than the old wooden structure. There are four deck spans over the river, two 145 ft. and two 105 ft. in length. In the centre is a draw span, a through truss, 215 ft. long and 24 ft. above high water. There is also 400 ft. of iron trestle work and a short span of 80 ft. across the tracks of the Boston and Providence Railroad. The bridge is about 40 ft. in width over all. The Boston Bridge Works will build the superstructure. The river piers rest on huge iron cylinders for foundation which are being made and sunk by the Builders' Iron Company, of Providence. The whole is after the design of Mr T. Cooper, 35 Broadway, N. Y.

THE Pittsburgh Junction Company is the name of a corporation formed to build and operate about five miles of track connecting the different systems of railroad passing through Pittsburg. Included in the plans are about 1800 ft. of iron trestle work, and an iron bridge across the river, after designs of Mr. T. Cooper. Over the main channel there are two spans of 210 ft. length, one of 250 ft. and one of 170 ft. Over the back channel there are three spans on a 7 degree curve, two of 100 ft. and one of 218 ft. length. The trestle work is under construction by Mr. B. W. C. Carroll of Pittsburg, and is nearly finished. Mr. C. J. Schultz of the Iron City Bridge Works, Pittsburg has the river spans in hand. Total cost of iron work $250,000.

VARIOUS bills have been introduced to the French Senate to permit the authorities of the ports of Bordeaux, Boulogne, Calais, Dieppe and Deulserque to collect taxes on the tonnage of vessels entering there, and on the traveller embarking or disembarking there. The money to be applied to the improvement of the harbors mentioned. At Boulogne, the improvements are to include the formation of an outer roadstead of considerable depth of water by the erection of a dike running out from the mole and a prolongation of the old jettv.

THE following is a synopsis of the bids received for stone and brick work on the basement and superstructure of the court-house and post office at Hannibal, Mo.:

Smith & Sargent, sand stone, $24,333; brick, $11.414.

W. R. & W. Haven, stone, $24,900; brick $10,450.

Larkworth & Menke, stone, $23,160; brick, $9,775.

James M. Marshall, stone, $42,500; brick, $12,856.

Contract awarded to Larkworth & Menke.

THE following is an abstract of the proposals for furnishing 1,700 cubic yds. of brush and 4,800 tons of stone for the improvement of Aransas Pass and Bay, Texas:

Hoag & Petitdidier, Pittsburg, Pa., brush, $5.30 per cubic yd.; stone, $4.70 per cubic yd.; aggregate, $112,660.

R. Kantners & Sons, Holland, Mich., brush, $4.25; stone, $6; aggregate, $101,050.

Rittenhouse Moore, Mobile, Ala., brush, $2.60; stone, $6; aggregate, $70,608.

A. M. Shannon & Co., Galveston, Tex., brush, $2.70; stone, $4.40; aggregate, $67,020.

Isaac Heffron, Galveston, Tex., brush, $2.60; stone, $5.30; aggregate, $69,640.

Contract awarded to Shannon & Co.

THE following is an abstract of the proposals for dredging the channels leading to the harbor at Baltimore, opened at Baltimore, August 11: Morris & Cummings Company, New York, all at 16¾c. per cubic yard, Craighill channnel at 14c. per cubic yard.

New York Steam Dredging Company, of New York, Brewerton Channel, 15c. per cubic yard; 100,000 yards in Craighill channel, at 13½c.

American Dredging Company, of Philadelphia, all at 15½c.

D. Constantine, Baltimore, Md., 100,000 yards in cut off, 25c.; 200,000 yards in Fort McHenry, 12c.

George C. Forbes & Co., Baltimore, Craighill, 11¾c.; Brewerton 12¾c.; Fort McHenry, 17½c.; 350,000 yards from channel to channel, in cut off, 23½c.

Thomas Porter, Jersey City, 500,000 yards in cut off, 19¾c.

Atlantic Dredging Company, Brooklyn, N. Y., all, 19½c.

National Dredging Company, Wilmington, Del., Craighill, 11 9-10c.; cut off, 20c.; Brewerton, 12 6-10c.; Fort McHenry, 19; all 16½c.

Ross & Sanford, Jersey City, Craighill, 11¾c.; cut off, 21 3-10c.; Brewerton, 13 9-10c.; Fort McHenry, 17 3-10c.

Edward Moore, Cortland, Me., cut off, 23c.; all 16½c.

Thomas P. Morgan, Washington, Fort McHenry, 16c. for all material which can be worked with clam shell dredge and 26c. for all hard material requiring dipper dredge.

Henry Du Bois & Sons, New York City, Brewerton, 10¾c.; 100,000 yards from Craighill, 10¾c.; 100,000 yards from Brewerton next to Fort McHenry, 10 3-8c. provided all bid for is awarded.

Benson & McRae, San Francisco, Craighill and Brewerton, 23½c. per cubic yard.

Railroads and Canals.

THE first locomotive ever seen in Guatemala arrived there July 19th.

A SURVEY is in progress for a new road from Chattanooga, Tenn., to Rome, Ga.

IT is proposed to issue bonds to the amount of $1,500,000 to complete the Massachusetts Central Railroad to Northampton. The road will be 104 miles long.

THE survey of the proposed Lake Shore Railroad from Laconia to Alton Bay is begun at the former place. It will take about three weeks.

THE branch line of New York, Philadelphia & Norfolk R. from Pocomoke to Accomac, on the eastern shore of Virginia, was opened August 18. It is 27 miles long.

PINE BLUFF, Aug. 21.—The construction train on the Pine Bluff and Swan Lake road started Monday. It is hauling iron, and track-laying will begin at once. Nine miles of the grade has been completed.

AFTER ten of the thirty miles of the Pike's Peak Railroad had been graded, work was abandoned because the bonds would not sell.

HARRISBURG, Aug. 19.—The Sheffield and Spring Creek Railway Company was chartered today. The road runs through Forest and Elk counties. Capital, $100,000. Wallace Horton of Sheffield, Pennsylvania, is President.

THERE are 580½ miles of main track in the Chicago, St. Louis and Pittsburg system. The present equipment consists of 190 locomotives, 67 passenger, 27 baggage, 7 mail and 6 express cars; 2,147 box, 670 stock, 754 gondola and 65 caboose cars; 1 tool car.

THE approaches to the new B. & O. railroad bridge over the Monohgahela river at Glenwood, are being constructed. The approach on the north side will be in the shape of a Y, and is being built of timber with heavy stone foundation.

THE Wisconsin, Minnesota, and Pacific has let a contract to Langdon & Co. for the grading of eighteen miles of an extension of the Cannon Valley from Waterville toward Mankato. The work will be commenced at once and completed this fall. The road is to touch Elysian, Eagle Lake, and Madison Lake.

IT is announced that chief engineer Green, with a full corps of assistants, will at once begin the survey of the Gulf & Ship Island line from Brandon to Ship Island, Miss. Arrangements have been made with the Vicksburg & Meridian to run trains over that road from Brandon to Jackson.

THE Engineers of the Grand Trunk Railway have completed drilling along the the bank of the River St. Clair, under which it is proposed to tunnel in order to avoid the delay in transferring to the American side. They bored through a stratum of clay, and struck rock at a depth of 100 ft. Soundings are now being made in the river with the same object in view.

THE Port Huron and Northwestern Railroad is now five years of age. It has 221 miles of track independent of sidings, thirteen locomotives, twenty-seven pasenger and two parlor coaches, and 297 freight cars. It also has 395 names on the pay-roll, and pays out for wages $12,000 each month, two-thirds of which amount goes to the City of Port Huron.

THE Imports of railroad materials into Brazil are steadily increasing. The principal American articles of this line imported are locomotives, while the principal portion of the rails are brought from England. Locomotives and rails are admitted free of duty into Brazil, so that the trade belongs to those who best comply with the requirements of the country.

WITHIN a few days the Chicago & North-Western will let the grading of 89 miles west from Valentine, Neb., the present western terminus of the Sioux City & Pacific. The extension will carry the end of the track well on to the northwest corner of Nebraska. The line is eventually to be extended, it is supposed, through Wyoming to a junction with the Central Pacific.

ENGINEER J. A. Farrington of the Portland & Ogdensburgh Railroad has begun the survey of Lake Shore R. The proposed road runs from Laconia to Alton Bay, to connect with the Boston & Maine road, a charter for the same being granted by the last Legislature. The survey will commence at Alton Bay. It is intended to complete the survey in three weeks, and ground will be broken early this fall.

WORK is progressing rapidly on the Baltimore and Ohio Company's new line from Baltimore to Philadelphia, and it is stated that about two-thirds of the entire road-bed is completed. The heavy cuts which have delayed progress are now nearly all finished, and at other points the work is progressing very favorably. At the bridge over the Susquehanna the caissons have been put in place, and work on the piers is progressing favorably.

BANGOR, Me., Aug. 26.—President Jackson of the Maine Central Railroad has received a despatch from the St. John Bridge Company that the bridge contractors will begin shipping the iron Montreal to-day for the new Cantilever bridge across the St. John River at St. John, N. B. The contractors also promise to have the bridge completed by November first. The piers for the bridge are completed and the excavations for th anchorages well along. It is also expected that the Intercolonial Railway will by that time have their extension completed, so that as soon as the bridge is finished freight from the eastern provinces can be at once transhipped without breaving bulk.

AN effort is being made to build a narrow gauge road from St. Joseph, Miss., to Smithville. The proposed route is through a fine district. Clay county is expected to subscribe $26,666.

THE Fitchburg road has now a double track from the Connecticut river to Boston, with a short distance between Orange and Erving. From Greenfield to North Adams the State road is double tracked, save a short piece between West Deerfield and Bardwell's Ferry bridge.

TRAINS began running August 10, on the Wisconsin, Iowa and Nebraska railroad from Waterloo, Ia. The road is now in operation from Waterloo to Des Moines, and from that city, by union with the Osceola and Southern, to Leon, in Decatur county, a total distance of 183 miles. Next year it will be extended to St. Joseph, Mo.

THE engineers in charge of the surveys of the proposed railroad from Chattanooga through North Georgia to Anniston, Ala., have reached Lafayette, Ga., and expect to complete the survey to Summerville by the 27th. This whole party maintain their original secrecy concerning the company for whom they are working and refuse to divulge a word relative to the matter.

LANCASTER, Aug. 19.—The first regular train over the Lebanon & Lancaster joint line left this city at 6.30 this morning and reached Lebanon at 8.05. The first train from Lebanon left there at 7.15 this morning and arrived in this city at 8.58. The distance between this city and Lebanon by the new line is shortened many miles. The new road branches from the Reading road at Manheim.

THE next station on the Houston, East and West Texas Railroad will be at a point near Buena Vesta, in Shelby County, just twenty-one miles from Nacogdoches. Iron is laid thirteen miles beyond Nacogdoches, and grading done some three or four miles further, leaving only a small gap, which will soon be completed. About twenty-four miles have been graded out of Shreveport in this direction, and the work is being vigorously pushed at both ends.

IT is probable that the contracts will be closed in a very few days for building the Cascade division of the Northern Pacific, and the expectation is that the twenty-five miles through the mountains will prove difficult and costly. Seven Howe truss bridges will be required, and a number of trestles, one of which will be 1,300 ft. long. In addition to this there are two tunnels, one 495 ft. long, and one 280 ft. long, LOT to mention some costly rock work at several places.

OMAHA, NEB., Aug. 22.—News has reached here that the Burlington & Missouri road has "jumped" the tunnel on the proposed line of the Greeley, Salt Lake & Pacific road at Dart Pass, northwest of Caribon in Colorado. This pass is the lowest and most feasible for a railroad over the range for a distance of 70 miles north and south. The Burlington and Missouri have a force of men at work in the tunnel, and have cut over 10 miles of timber on the grade of the Utah, Salt Lake & Pacific, and will have the line cleared from Rollinsville to the tunnel and be ready for the graders in a short time and will then push westward.

NEW TRACK LAID.—Chicago, Burlington and Quincy—The new Concordia branch is extended southwest to Concordia, Kan., 45 miles.

Topeka, Salina and Western—Track laid from Council Grove, Kan., west to Wilsey, 12 miles.

There has been laid 2107 miles thus far in 1884 against 3078 miles at the corresponding time in 1883, 5984 miles in 1882, 3459 miles in 1881, 2823 miles in 1880, 1446 miles in 1879, 1049 miles in 1878, 1013 miles in 1877, 1273 miles in 1876, 613 miles in 1876, 962 miles in 1874, 2025 miles in 1873 and 3962 miles in 1872. These statements include main track only, no account being taken of second tracks or additional tracks or sidings.

CONTRACTS have recently been made for the construction of that portion of the Milwaukee, Lake Shore & Western Railroad, between Ashland and the Montreal River, calling for the completion of the line by July 15 next. Work on this section of the road is already in progress, and the probabilities are that it will be completed before the time specified by contract. In the meantime, the company will continue construction work west from the present terminus, and it is expected that the Montreal River will be reached by October. Several of the richest mining properties in Northern Michigan are situated on the Lake Shore's new line. At Ashland the railway company will build docks and have them ready for use as soon as the road is completed.

ABSTRACT of proposals received and opened by Major Mackenzie, Corps of Engineers, U. S. A., Rock Island, Ill., at 2 P. M., August 23, 1884, for dredging in the harbor at Rock Island, Ill.

No.	Name of Bidder.	Residence.	Dredging and Depositing material at a distance not to exceed one mile. 26,000 yds.				For use of Dredge and plant per hour. 200 hours.				Total.
			per yard.		amount.		per hour.		amount.		
			$	cts.	$	cts.	$	cts.	$	cts.	$
1	B. E. Linehan.	Dubuque, Ia.	..	22	4,400	..	9	50	1,900	..	6,300
2	A. J. Whitney.	Keokuk, Ia.	..	11½	2,300	..	10	..	2,000	..	4,300
3	H. S. Brown.	Quincy, Ill.	..	25	5,000	..	12	..	2,400	..	7,400
4	C. S. Whitney.	Keokuk, Ia.	..	23	4,600	..	8	..	1,600	..	6,200

SIX railway projects are agitating Chattanooga at present. They are the Belt Railroad, the railroad to Lookout, the railroad from Chattanooga to Rome, the Chattanooga and Western, the Chattanooga Elevator and the East Chattanooga.

THE President of the Chesapeake and Nashville Railroad reports that the building of the road is a certainty. Work will be begun within sixty days and pushed with all the rapidity that energy and money can command The new road will form the short line from Cincinnati to Nashville by thirty-five to forty miles, and the short line between Nashville and New York by 100 miles. The route, as surveyed, leaves points on the Kentucky Central and Cincinnati Southern within 100 miles of Cincinnati, and makes almost an air line to Nashville, the distance being 150 miles. For some forty miles the route is already graded, the company having acquired the control of the abandoned Cumberland and Nashville Railroad.

ANOTHER instalment of five dollars per share on the $15,000,000 stock of the South Pennsylvania Railroad Company was paid up to-day; this will put $750,000 cash in the treasury of the company. Work on the road is progressing rapidly. The tunnels are all under contract, bridges are being built and the road is being pushed to completion with more energy than is generally understood by the public. This road, as the rival of Pennsylvania and a feeder to Reading, will become one of the most important lines in the State. It ought to be in working order by the spring of 1886. What with this line, the Baltimore & Ohio road between this city and Baltimore, the Pennsylvania's extension into the Schuylkill Valley, and the prospects of the Sea Board Pennsylvania route, a projected line across the State connected with Lackawanna, railroad building is going on in this State at a more rapid rate than anywhere else in the Union.—Phila. *Press*, Aug. 21, 1884.

THE Union Pacific Railway Company is laying a second track between Omaha and Papillion, Neb., a distance of fifteen miles, which, it is intimated, will be used to afford an entrance into Omaha for the Missouri Pacific, whose trains now run over the Union Pacific from Papillion. The Utah Central will at once build a branch from Milford to the Cave mine, in Beaver County, Utah, a distance of 8 miles. On the Magdalena Branch of the Atchison, Topeka and Santa Fe Railroad, which is to run from Socorro, N. M., west thirty-five miles to the Magadalena mines, seven miles of track have been laid and work has been suspended until fall. The Lake Valley Branch has been built this year from Nutt, N. M., north-west to Lake Valley, thirteen miles.

ON Aug. 21 a car jumping the track caused the total wreck of the bridge at the canal crossing of the Phila. & Reading R. R. in Harrisburg Pa.

The mischief making truck was on the sixteenth car from the front of a freight train, it left the track some distance from the bridge; when the car struck the bridge truss the entire abutment face nearest the train was torn out and seven cars were precipitated into the gap.

The bridge was iron, built in 1881 to replace one destroyed by a similar accident on Aug. 14, 1880, it cost about $18,000. The entire damage sustained by the present wreck is estimated at $30,000.

A correspondent, who was present just after the wreck, informs us that the facing of the abutment fell out in a mass, it was no thicker than the bed-plate of the bridge and contained not a single header to bind it to the backing masonery. Had the masonery been better built the abutment and probably the bridge would have stood the shock.

LA SOCIETE HOUILLERE, of the city of Lievin, France, offers to lend the Government 1,000,000 francs to assure the completion of the branch canal from the canal de la Deule to the city of Lens. This will connect an important portion of the Pas-de-Calais coal basins having an annual production of 2,000,000 tons with an extensive net work of navigable water ways.

SOUTH PENNA R. R. NOTES.—The tunnel on Div. 2 is progressing at the West approach, Mason, Roaser & Dickey, the contractors, broke ground there on Feb. 19; on June 12 West heading was turned; on June 4 East heading was turned. At the Sideling Hill Tunnel the headings are fairly in, but not much more; the same is the case at Ray's Hill Tunnel. The Allegheny Tunnel is making steady but not rapid progress, the headings are 800 ft. in; lately 73 ft. was driven in one week as an exceptional rate. P. & T. Collins are reported as making very rapid work on their sections, they have finished five miles of grading on a sub-division of 10 miles. At the Quemahoning Tunnel there is two months work on the approach yet to be done before the portals will be reached; the material is hard pan with very little rock on the West End and considerable water at both ends. David Page & Co. have the contract for 12 miles of grading from Laurel Run west.

S. P. R. R. Transit.

MEXICAN RAILROAD NOTES.—The plans of the Tuxtla Railroad, forwarded to the Secretary of Public Works for approval, cover the first 10 kilometers of the road. The starting point is Amatixpam on the San Juan river, situated 33 meters above the sea, and at the end of the 10 kilometers, the altitude is 65 meters above the sea.

Over 100 men are now employed on the grade between Vireyes and Perote on the line of the International Railroad.

The Puebla and Izùcar Railroad carried 11,717 passengers between Puebla and Atlixco during June. The time fixed for the replacing of animal traction by steam was July 19, but it has been extended to December.

The Merida and Valladolid Railroad are operating 29 kilometers from Merida to Nolo, and during June moved a total of 6,841 passengers.

On the branch of the Mexican Central Railway from San Luis Potosi to Tampico the following amounts have been expended in preparing the road bed of the respective kilometer:

Kilometer	117	$25,893.35
"	118	34,945.31
"	119	22,942.16
"	120	23,654.65
"	121	19,431.51
"	122	29,701.13
"	123	83,555.12

Mexican Financier.

THE terms on which companies have lately undertaken railways in India are as follows, in all of which the companies have received land free of cost:—

(*a*) The plan known as the "Bengal and North-western" terms, under which the company makes the line upon its own responsibility and receives the whole of the profits of the undertaking, the line reverting to the State at the end of 99 years. The terms of purchase by the government under this plan are that, at the end of 30 or 50 years, the government may buy the company's interest at the rate of 25 years' purchase of the average annual net earnings of the line for the previous five years.

(*b*) The plan known as the "Bengal Central" terms, under which the company receives a guarantee of four per cent. on paid-up capital during construction, which advance is to be repaid with simple interest by the company to the government by a contribution of half its net earnings over five per cent. The terms of purchase are, that at the end of 30 or 50 years the government may buy the undertaking at the rate of £125 for each £100 of stock.

(*c*) The "Southern Mahratta" terms, under which the company practically acts as agent for the government, receiving a guarantee of three and a half per cent., plus one-fourth of the net receipts during the currency of the agency, which is terminable after the twenty-fifth year, or at subsequent intervals of ten years, at the option of the government, while the company, by giving a year's notice, may demand the return of their capital. This guarantee is payable in rupees, such a number of rupees being guaranteed as will ensure to the holder of stock a sterling payment in London of three and a half per cent. (plus at least one-half per cent. until 1889), after which the guarantee is the equivalent of three and a half per cent. sterling in London, plus one-fourth of the net receipts, which are payable in India.

Each is suitable under certain circumstances.

(*a*) When a line may be expected to give a considerable immediate return, the Bengal North-western terms are reasonable.

(*b*) When the prospect is not so well assured the Bengal Central terms offer a greater inducement to the investor, by guaranteeing interest on capital during construction.

(*c*) The Southern Mahratta terms offer a permanent security to investors, which is equal to the security of the government of India, with the addition of a quarter of the net receipts of the line.

THE Pennsylvania Railroad has surveyed a route for a new railroad between Absecon, Sea Haven and Barnegat City, N. J., and, a charter having been obtained, the work of construction will commence the 15th of next month. The road is to be called the Long Beach Railroad.

THE raising of the roadbed of the St. Louis & Cairo Narrow Gauge between Cairo and Hodges Park a distance of 12 miles, places it two feet above the highest flood ever known.

Army and Navy Notes.

THE electric light is evidently destined to play a considerable part in the warfare of the future. If properly employed by any army in camp or bivouac, it ought to make night attacks and surprises impossible. A storming party might as safely attack a town at noonday as at midnight under the glare of a dozen arc lights. In naval battles also it is to be largely used, and the masthead electric lights is to be relied upon as one of the great defenses of an ironclad against torpedo boats. Recently at Aldershot experiments were tried for a more benevolent purpose. Movable electric light wagons will be used to illuminate at nightfall the area on which a battle has been fought during the day, so as to reveal the wounded men who lie there to the searchers of the bearer company and the ambulance corps. The operations were successful enough to encourage further experiments.

THE joint Congressional committee on ordnance has elicited a certain amount of fact and opinion on the subject of more or less value. The persons questioned generally did not doubt that ships and ordnance could be manufactured in this country as cheaply as in England after the artisans were given a little time in which to acquire proficiency. They were unable to understand, however, what good could come of manufacturing cannon for which there is no market, the government having shown its preference for war implements of foreign make.

The result of these New York examinations certainly does not indicate that there are any great obstacles in the way of manufacturing cannon of all sorts in this country, provided the government is disposed to patronize home industries. The situation is aptly described by Senator Hawley in a recent interview:

"In answer to circulars sent out two or three weeks ago," said he, "we received communications from upward of twenty prominent manufacturers of steel suitable for guns, armor-plating, etc., and these communications we have read through and discussed. We have also talked over our plans for further inquiry, the way in which the work should be subdivided, and so on. Two of the committee will probably go to California to look at the harbors and the condition of iron and steel manufacture there. Others of the committee will pursue similar inquiries in other directions. There is no doubt that anything we want in the line of our inquiries can be produced in this country if there is a customer for it. If Uncle Sam will be a liberal purchaser there are plenty of enterprising firms to supply him and plenty of good engineers. Heretofore there has been no inducement to any capitalist in the United States to provide the costly plant needful.